diesel power

April 1955

ENGINE SPECIFICATIONS

SUBSTANTIAL OVER 6 YEARS

WITH Texaco's help, this plant (name on request) has enjoyed substantial savings for more than six years. Bearing wear is noticeably low and ring life exceptional. In fact, recent overhaul showed rings in such fine shape they could be put right back for re-use. Engines are running clean, lube oil consumption and maintenance expense are minimum.

Benefits like these explain why—

For over 20 years, more stationary diesel horsepower in the U. S. has been lubricated with Texaco than with any other brand.

You can enjoy similar benefits by lubricating with one of the *Texaco Ursa Oils*—the famous line of lubricating oils especially refined to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls.

A Texaco Lubrication Engineer will gladly help you select the proper one to assure best results from your engines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN:
TEXACO STAR THEATER
starring
DONALD O'CONNOR
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on television...
Saturday nights, NBC.

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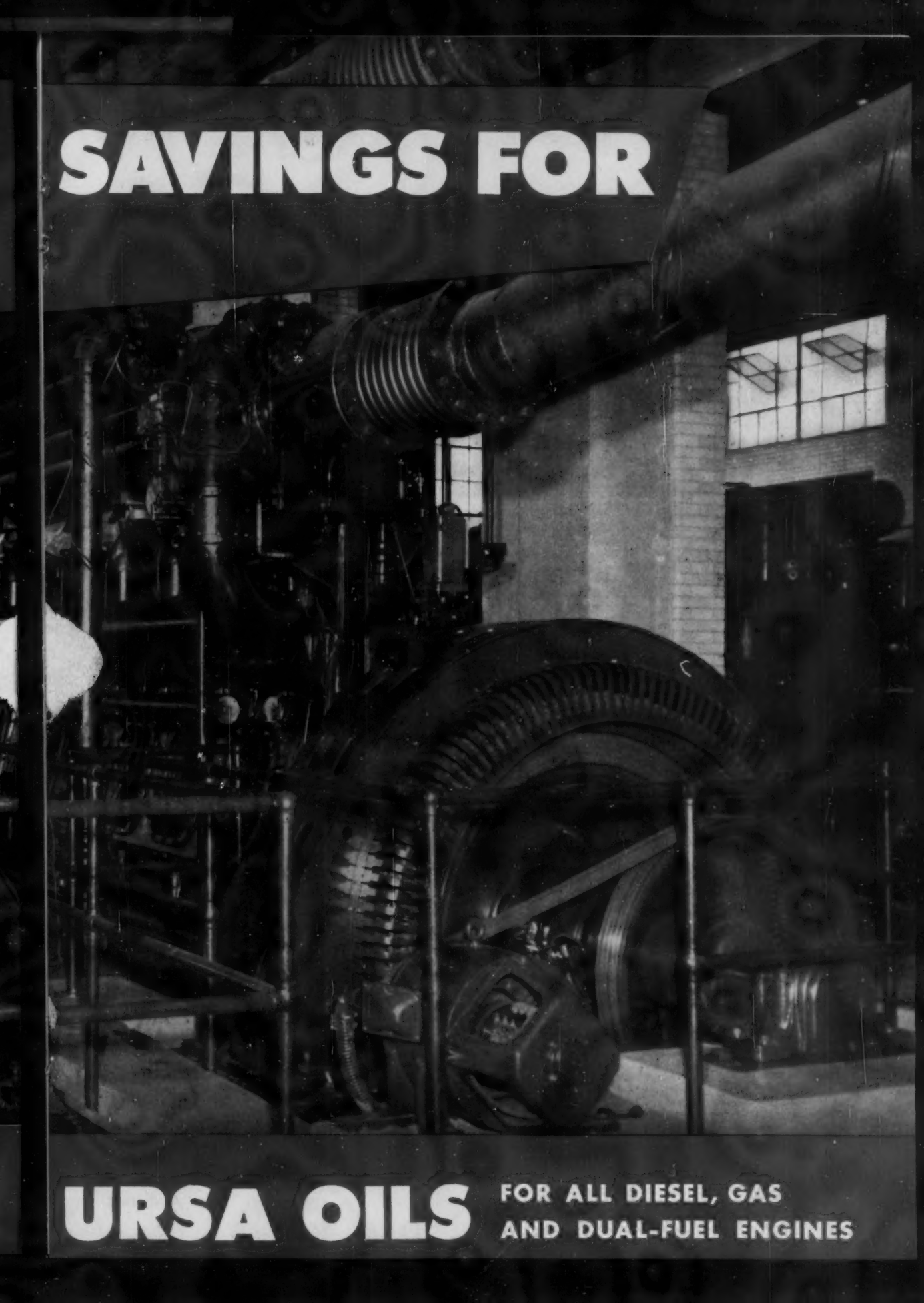
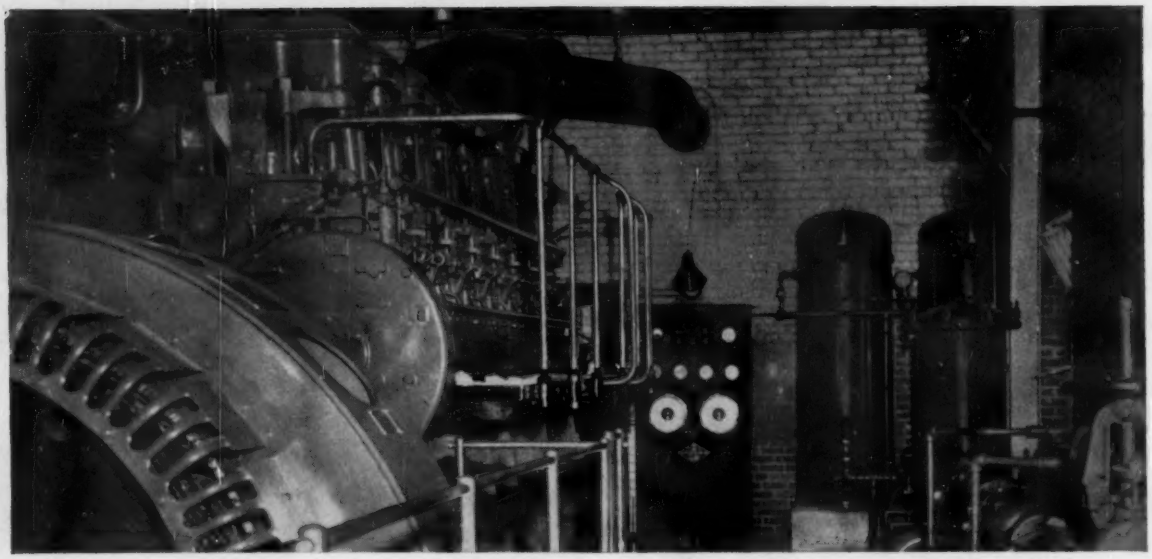

SAVINGS FOR
URSA OILS
FOR ALL DIESEL, GAS
AND DUAL-FUEL ENGINES

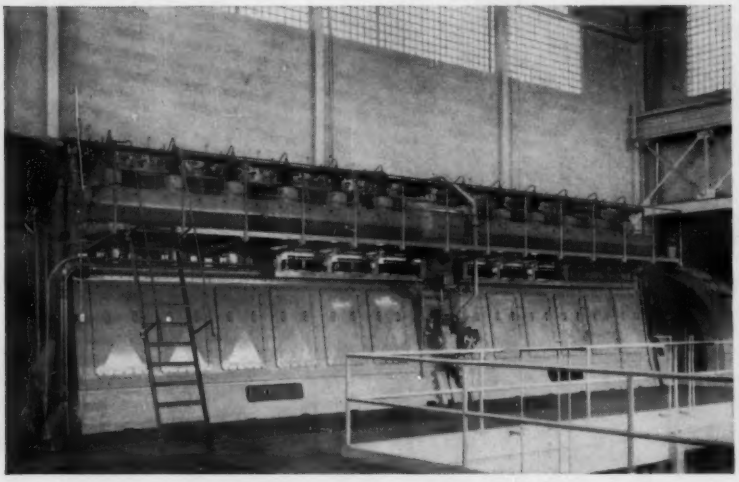


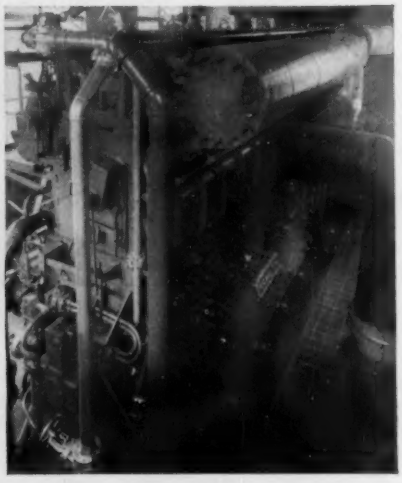
BALDWIN

600 SERIES

12¾ x 15½ turbocharged diesels with 6 or 8 cylinders. Develop 620 to 1750 hp at 514 to 625 rpm.

QUAKERTOWN, PA., switched to diesel power generation with this 1560 hp Baldwin and saved three ways . . . (1) Initial cost was appreciably less than alternative boiler and turbine. (2) Medium speed (600 rpm) Baldwin is very economical in use of fuel and lube oil. Total operating costs, including amortization, are 60% less than purchased power. (3) Ready availability of the Baldwin for standby service has cut weekend operating costs 25%.





HAMILTON

21½ x 27½

diesel and dual fuel engines. Available in 5 to 12 cylinders with a net horsepower range from 2350 to 5450.

WRITE for more facts about these B-L-H diesels that are your most economical and dependable power generating source in the 500 to 20,000 kw range.

DECATUR, IND. (Heavy Fuel) This 3810 kw Hamilton 21½ x 27½ engine operates 18 to 20 hours daily burning heaviest residuals with an *absolutely invisible exhaust*. There's been no unusual piston ring or liner wear. Decatur's fuel cost is just 4.6 mills per kwh.

ROBSTOWN, TEX. (Dual Fuel) This 2050 kw Hamilton 21½ x 27½ engine has been performing efficiently on dual fuel since 1952. Equally high efficiency is reported for two newer, 9 cylinder, Hamilton dual fuel engines like this at Great Bend, Kansas.

BALDWIN-LIMA-HAMILTON

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diesel power

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Another contribution from CLEVITE...this useful manual for the bearing service industry

● Here's a book that has been developed to help mechanics, parts managers, foremen and others who buy and install engine bearings. It is one more of a continuing parade of contributions made by the world's foremost designer and builder of original equipment engine bearings.

We've called this valuable book "Mechanics' Engine Bearing Reference Manual". It explains in more than 100 pages of easy-to-read technical data how to determine and correct the causes of bearing failure and how to properly fit new bearings.

You can get your complimentary copy through your nearby N.A.P.A. jobber . . . your local and dependable source of the famous Monmouth* line of Clevite* 77 and Micro* bearings . . . identical with original bearings installed in most automotive equipment.

*The words Monmouth, Clevite and Micro are registered trade marks of Clevite Corporation.

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Clevite Service
The Cleveland Graphite Bronze Co.
Division of Clevite Corporation, Cleveland, Ohio, U. S. A.

NAPA Assurance of Quality

Your NAPA Jobber is a Good Man to Know!

"Smoother stripping -cuts cable costs"

Allison TORQMATIC equipped Osgood dragline owned by J. C. Kitzmiller Coal Co. Unit has 3-yard bucket, 80 foot boom; strips 1000 tons of coal per month

AFTER **2,000** hours of low-cost strip-mining, veteran mine owner J. C. Kitzmiller reports "smoother stripping — reduced cable cost" due to shock-free power transmission in his Osgood dragline. The savings he's made with his Allison TORQMATIC Converter have made him decide to specify Allison TORQMATIC DRIVES in future equipment.

He's spending less for cable replacement in his Osgood dragline because the TORQMATIC Converter protects cable by absorbing sudden shock loads.

He's spending less for dragline repairs, too. The TORQMATIC Converter gives the operator time to cut off power—"throw out the drag"—when the bucket hits a snag, guards boom and drive line from harmful overloads.

And he's getting more work from his drag because with fewer repairs it stays on the job *earning* money—out of the shop *costing* money.

The TORQMATIC Converter matches engine power to load demand, helps prevent harmful engine lugging and stalling. It multiplies engine torque up to 3½ times—broadens the engine's effective horsepower range.

When load demand is equal to, or less than, engine torque the Allison TORQMATIC Converter acts as a fluid coupling to conserve fuel, boost engine life. This feature is standard equipment in every Allison Converter.

You can produce more for less with shock-free TORQMATIC power transmission in your 40- to 400-horsepower gasoline or Diesel equipment. Ask your manufacturer or dealer about TORQMATIC DRIVES in your equipment or write for more information to: Allison Division of General Motors Box 894S, Indianapolis 6, Indiana

ALLISON TORQMATIC CONVERTER

Simple Design — one-piece cast converter elements — minimum maintenance

Compact, easy to install in existing equipment

Designed for power applications in the 40 to 400 horsepower range

Longer Equipment Life — absorbs shock, eliminates harmful engine lugging, cuts maintenance costs

GM GENERAL MOTORS

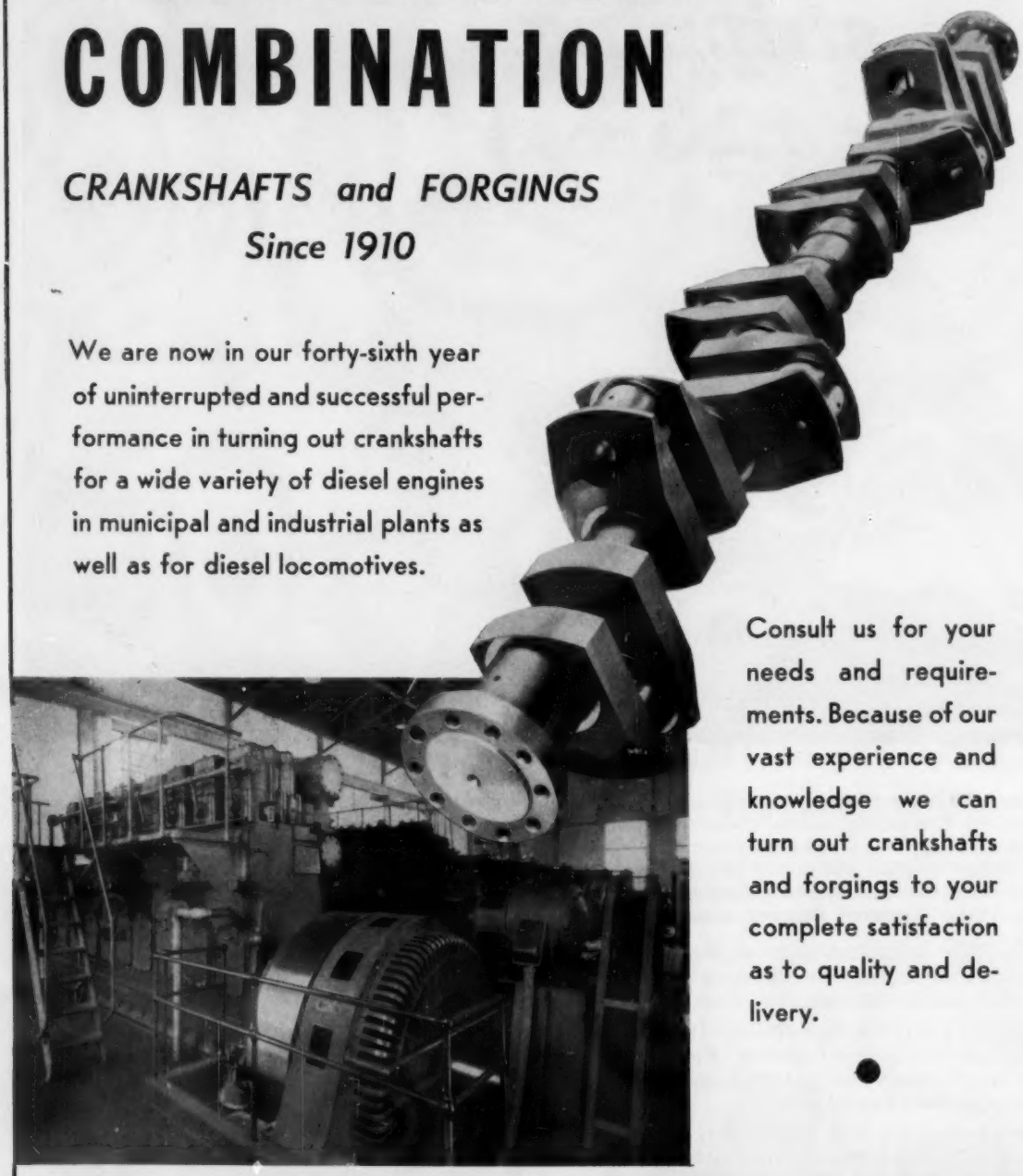
Allison TORQMATIC DRIVES

Compact, efficient hydraulic drives for Cranes * Trucks * Tractors * Scrapers * Shovels * Drilling and Servicing Rigs

A SUCCESSFUL COMBINATION

CRANKSHAFTS and FORGINGS
Since 1910

We are now in our forty-sixth year of uninterrupted and successful performance in turning out crankshafts for a wide variety of diesel engines in municipal and industrial plants as well as for diesel locomotives.



Consult us for your needs and requirements. Because of our vast experience and knowledge we can turn out crankshafts and forgings to your complete satisfaction as to quality and delivery.

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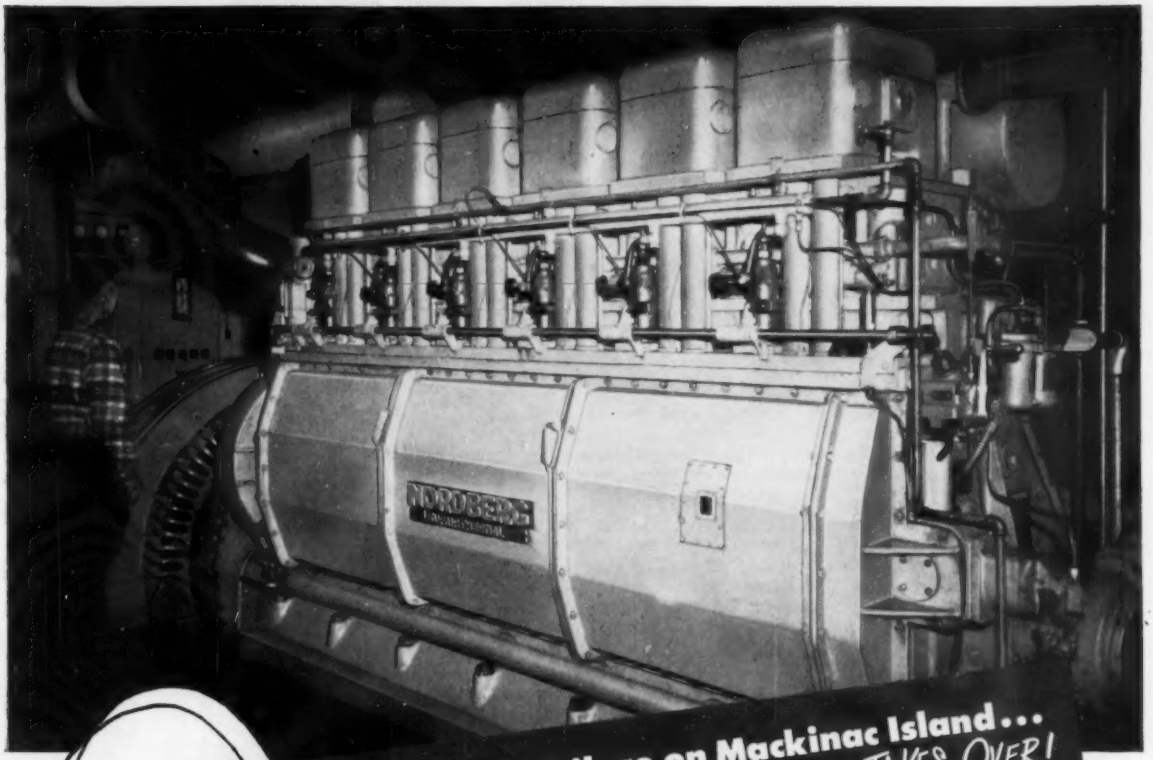


Emergency power failure on Mackinac Island... Nordberg SUPAIRTHERMAL Diesel TAKES OVER!

● Electric service reaches Mackinac Island via submarine cable from the Michigan Upper Peninsula. When this cable was damaged recently, main power on the Island was interrupted about eight days, while special equipment was moved in to raise the cable and splice the break. According to the Edison Sault Electric Company, *"If the new Nordberg standby engine had not been immediately available . . . it is questionable whether or not service could have been maintained . . ."*

MACKINAC ISLAND, famous northern Michigan resort area, is served by the Edison Sault Electric Company, progressive utility with headquarters in Sault Ste. Marie, Mich. When unusual circumstances caused a temporary main power failure recently, the job of supplying the necessary electric power to Mackinac Island residents was immediately assigned to a new Nordberg 1200 hp *SUPAIRTHERMAL* Diesel Generating Unit.

Installed on Mackinac Island for emergency, as well as "peaking" service during the heavy tourist season, the new 800 kw Nordberg Diesel "took over" the full demand for about eight days, while the primary power line was being repaired. This installation is a good example of Nordberg engines serving the country's utilities, for both standby and main power supply. The next time you have a power problem, think of *Nordberg* . . . builder of America's largest line of heavy duty engines from 10 to over 10,000 hp. *Nordberg Mfg. Co., Milwaukee, Wis.*

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P254

ELECTRIC POWER

DELCO-REMY ThunderVolt A.C. GENERATORS HEAVY-DUTY (180-Ampere Output Capacity)

Delco-Remy ThunderVolt A.C. generators are the hearts of 12-volt A.C.-D.C. electrical systems designed specifically for modern Diesel buses with fluorescent lighting and extra-heavy electrical loads.

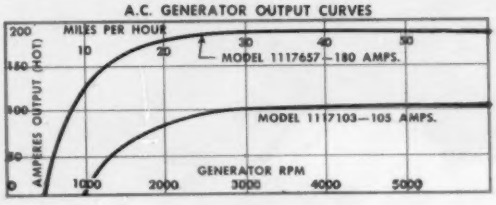
Desirable performance characteristics include cut-in at low generator rpm . . . maximum output of 180 amperes at approximately 2000 rpm. The new generators supply not only alternating current for fluorescent lights but also ample direct current for the heaviest electrical loads coupled with lengthy engine-at-idle periods.

Impressive features of the new generators are their light weight, very high output capacity, and ability to operate over a wide speed range with greatest efficiency. Specify Delco-Remy electrical equipment on your new buses.

A.C. GENERATOR PERFORMANCE DATA

Model	Volts	Cut-In RPM*	Curb Idle Amperes*	Maximum Amperes	Power Watts	Recommended For
1117103	12	975	6	105	1260	All speeds.
1117657	12	625	100	180	2160	All speeds.
1117062-3-4	6	750	30-40	90	540	All speeds.
*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)						

A.C. GENERATOR OUTPUT CURVES



DELCO-REMY ThunderVolt D.C. SPLIT-FIELD GENERATOR HEAVY-DUTY

(120-Ampere Output Capacity)

The Delco-Remy 12-volt split-field generator and its companion regulator are rugged and dependable—designed to meet the needs of Diesel transit buses having increased electrical loads coupled with a high percentage of engine idling time.

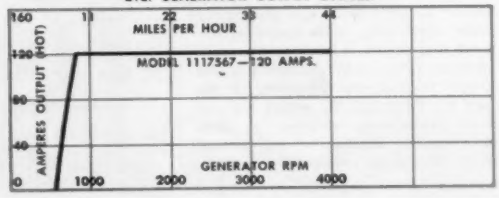
Desirable performance characteristics include low cut-in, high output at engine idle, and quick attainment of maximum output. Note performance table at right.

Operating benefits include reduced battery cycling, long battery life, and a simplified electrical system with sustained voltage—at no sacrifice in ruggedness or dependability.

D.C. GENERATOR PERFORMANCE DATA

Model	Volts	Cut-In RPM*	Curb Idle Amperes*	Maximum Amperes	Power Watts	Recommended For
1117567	12	550	70	120	1440	Low speed & idling.
*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)						

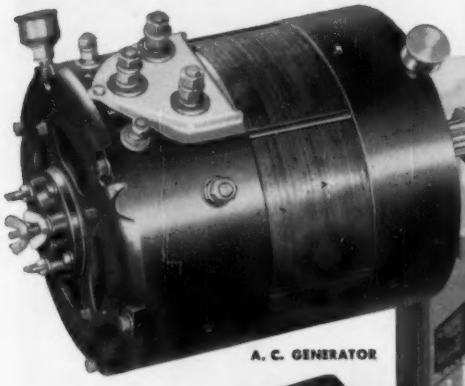
D.C. GENERATOR OUTPUT CURVES



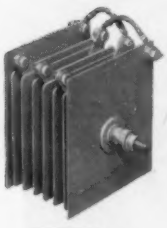
Delco-Remy
ThunderVolt
ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

right for the job



A. C. GENERATOR



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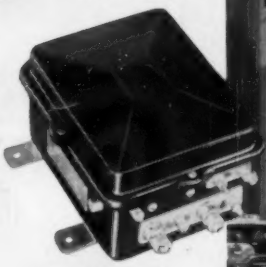
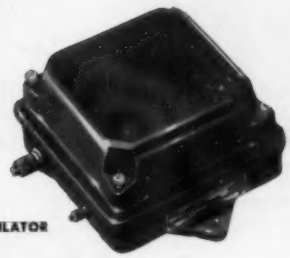


REGULATOR

D. C. GENERATOR



REGULATOR

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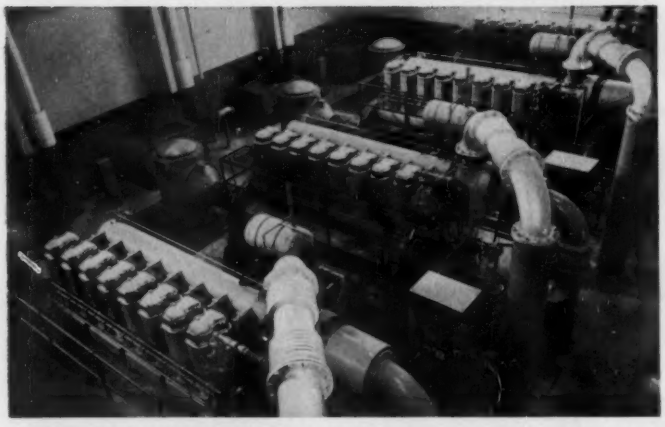
WHEREVER WHEELS TURN OR PROPELLERS SPIN

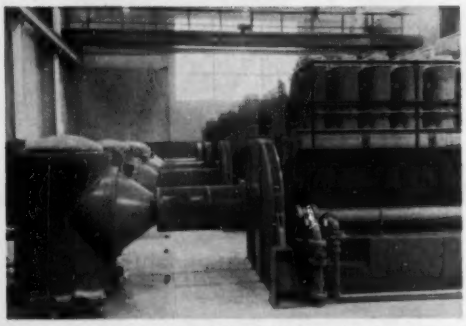
The Oakland storm water pumping station is equipped with four Enterprise Turbocharged Diesels driving huge mixed-flow pumps. Drainage conduits are large enough to drive an auto through.

Early construction stage of new pumping station, heart of the East Bay city's lowland drainage and flood control project.

Let it pour! Oakland licks storm flood problem with new diesel pumping plant



The four 1200 BHP Enterprise DSG-318 Engines are completely automatic, require no attendant. Rising water level starts engines, regulates speeds for proper pumping capacity.



Eight-cylinder engines drive giant axial flow pumps though flexible couplings and right angle gears.

650 million gallons of storm water can be pumped through this Enterprise equipped station in 24 hours—a full railroad tank car every second!

Will your city be faced with flooded streets and costly water damage this year? Your flood problem can be prevented by calling in qualified Enterprise engineers now to assist you in planning adequate, independently powered flood control facilities. No matter what pumping capacities you require, there's an Enterprise Engine designed to do the job more efficiently and at lower cost.

Enterprise Engines for every municipal need. Whether it's for flood or water supply pumping systems, stationary or portable electric generating plants, or for sewage disposal, you'll find there's an Enterprise Engine ideally suited for most dependable service. Contact the Enterprise Engine sales office in your area, or write us direct about your problem.

Over a million horsepower at work the world over!

ENTERPRISE dependable ENGINES

THE CHOICE OF POWER EXPERTS

ENTERPRISE ENGINE & MACHINERY CO. • **Subsidiary of General Metals Corporation** • **18th and Florida Streets, San Francisco 10, California**

Boston • Chicago • Denver • Jacksonville • Kansas City • Los Angeles • Minneapolis • New Orleans • New York • San Diego • Seattle • St. Louis • Washington, D.C.

County Courthouse, Newkirk, Oklahoma

Where does the Court get its power?

For seven years in Newkirk, Oklahoma, one powerful machine controlled the power of the court... a Fulton 800 H.P. dual-fuel generating unit, lubricated by Cities Service Pacemaker #5 Oil.

But it wasn't only the court that depended upon this one machine . . . the entire town relied upon it. If the machine failed, so might the annual grain harvest, for Newkirk's grain elevators require great quantities of power.

BUT THE FULTON GENERATING UNIT AND CITIES SERVICE LUBRICATION PROVIDED FAULTLESS SERVICE. There was never a breakdown.

Newkirk's power boss, Superintendent of Utilities Ralph E. Cottrell, sums it up this way: "Using Pacemaker #5 in the engine's crankcase and cylinder lubricators, we not only enjoyed trouble-free operation during those seven years, but also surprisingly little wear and oil consumption. Rings, bearings and liners remained in top notch condition and the engine piled up well in excess of 6000 horsepower hours per gallon of oil."

This is but one more powerful story of Cities Service Lubrication . . . a graphic illustration of the kind of results you can expect from these highest quality lubricants. Why not get the whole story from a Cities Service Lubrication Engineer? Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

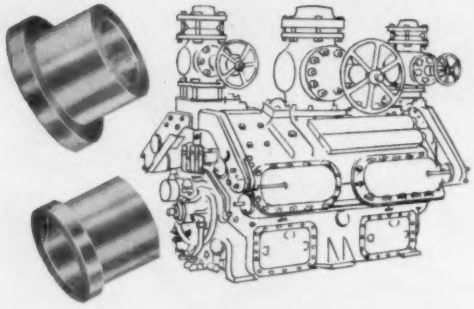
Ralph E. Cottrell, Power Boss of Newkirk, Oklahoma. All of Newkirk depends on him as Supt. of Utilities. He depends on Cities Service Lubricants for town's power generators.

Powerful Machine Behind The Court is this Fulton 800 H.P. dual-fuel generating unit. For seven years Newkirk's only major power source, it gave "faultless performance" using Cities Service Lubricants.

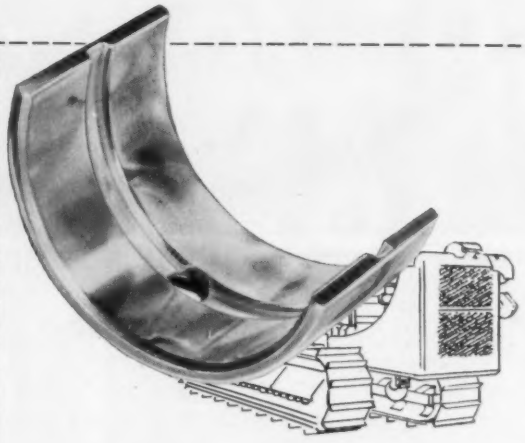
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

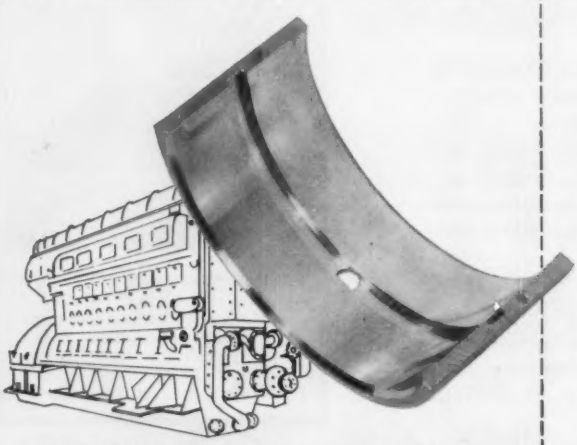
Suppose, like these designers, you just want to eliminate trouble



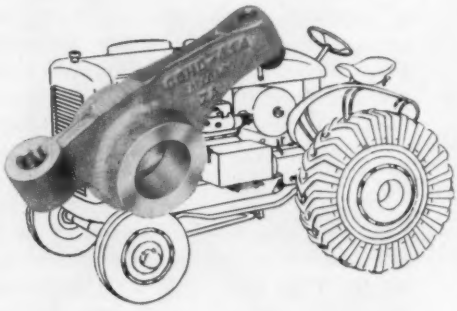
YORK CORP.—use sleeve-type load and thrust bearings of cast aluminum alloy that last 20,000 hours and more. They solve service problems, carry heavier loads, are easier to machine, prevent shaft damage.



CATERPILLAR TRACTOR CO.—use solid aluminum for main connecting rod and thrust bearings in their tractor. In addition to longer life, the solid aluminum bearings showed a much lower percentage of failures than previously used materials.



FAIRBANKS, MORSE & CO.—switched from steel-backed or bronze-backed babbitt to solid aluminum for crankshaft bearings. They report an increase of at least 10 times in bearing life, with added advantages of corrosion resistance, freedom from shaft damage and reduced rotating weight.



SCHRAMM, INC.—use an entire rocker arm cast of Alcoa Aluminum bearing alloy. They avoid costly forging dies for steel arms and costly machining necessary for conventional bushing inserts.

● There were three points in manufacturing history when designers could have demanded 24-carat gold for bearings. It happened once during World War I, when the Liberty Engine was born. Again when the Luftwaffe became the scourge of World War II skies. It happened when Rolls Royce built their Bentley automobile for millionaires.

What did these designers use when they could have demanded anything? ALUMINUM. And because of their early conviction that aluminum was the finest bearing material obtainable, scores of companies today are switching to solid aluminum bearings.

What do they get from aluminum that neither babbitt nor bronze nor any multimetalic combination offers? *No bond problems.* One-piece aluminum bearings *take tremendous loads* without failure.

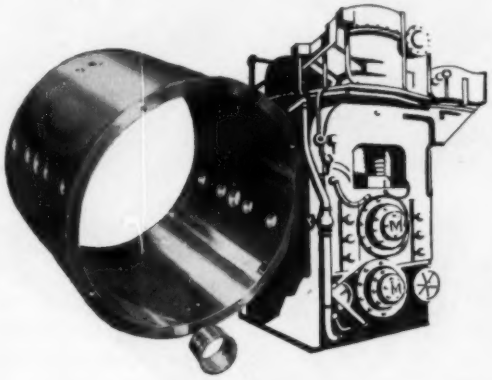
Where additive oils are used, these engineers specify aluminum, knowing its *natural corrosion resistance* protects them. Where hot spots are likely, they know aluminum's *swift thermal conductivity* lessens seizures. Where dirt is a problem, they know aluminum *embeds particles* almost as well as babbitt —far better than bronze.

Who will be next to quadruple the life of his bearings? It could be the man who fills out the coupon below.

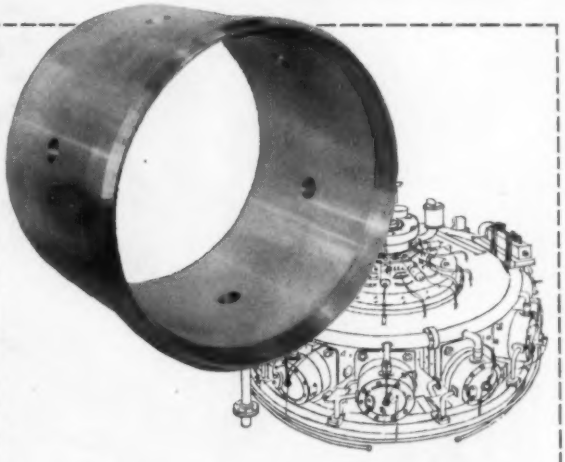
ALUMINUM COMPANY OF AMERICA
1988-D Alcoa Building, Mellon Square, Pittsburgh 19, Pa.
Gentlemen: I would like to discuss aluminum bearings with an Alcoa sales engineer.
Name_____ Title_____
Company_____
Street and Number_____
City_____ Zone_____ State_____

Your Guide To Aluminum Value

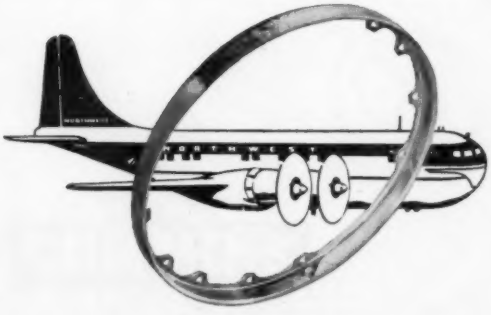
BEARINGS MADE OF ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA



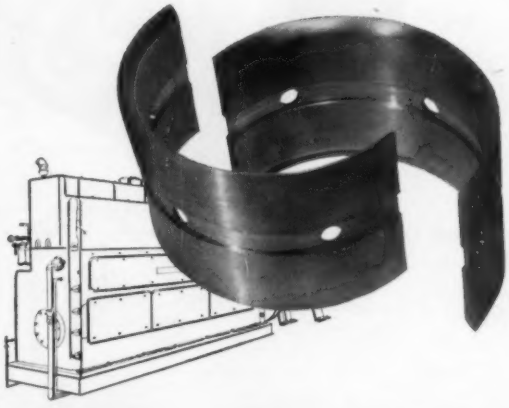
MORGAN CONSTR. CO.—use solid aluminum for their Morgoil Roll Neck Bearings in rolling mills. They report longer life than previously used steel-backed cadmium bearings, better corrosion resistance, better performance at high and low speeds on both hot and cold mills.



NORDBERG MFG. CO.—use full, round, solid bushings of Alcoa® Aluminum. They prove far superior to babbitt—give longer life—lessen maintenance interruption. Over 20,000 operating hours without failure.

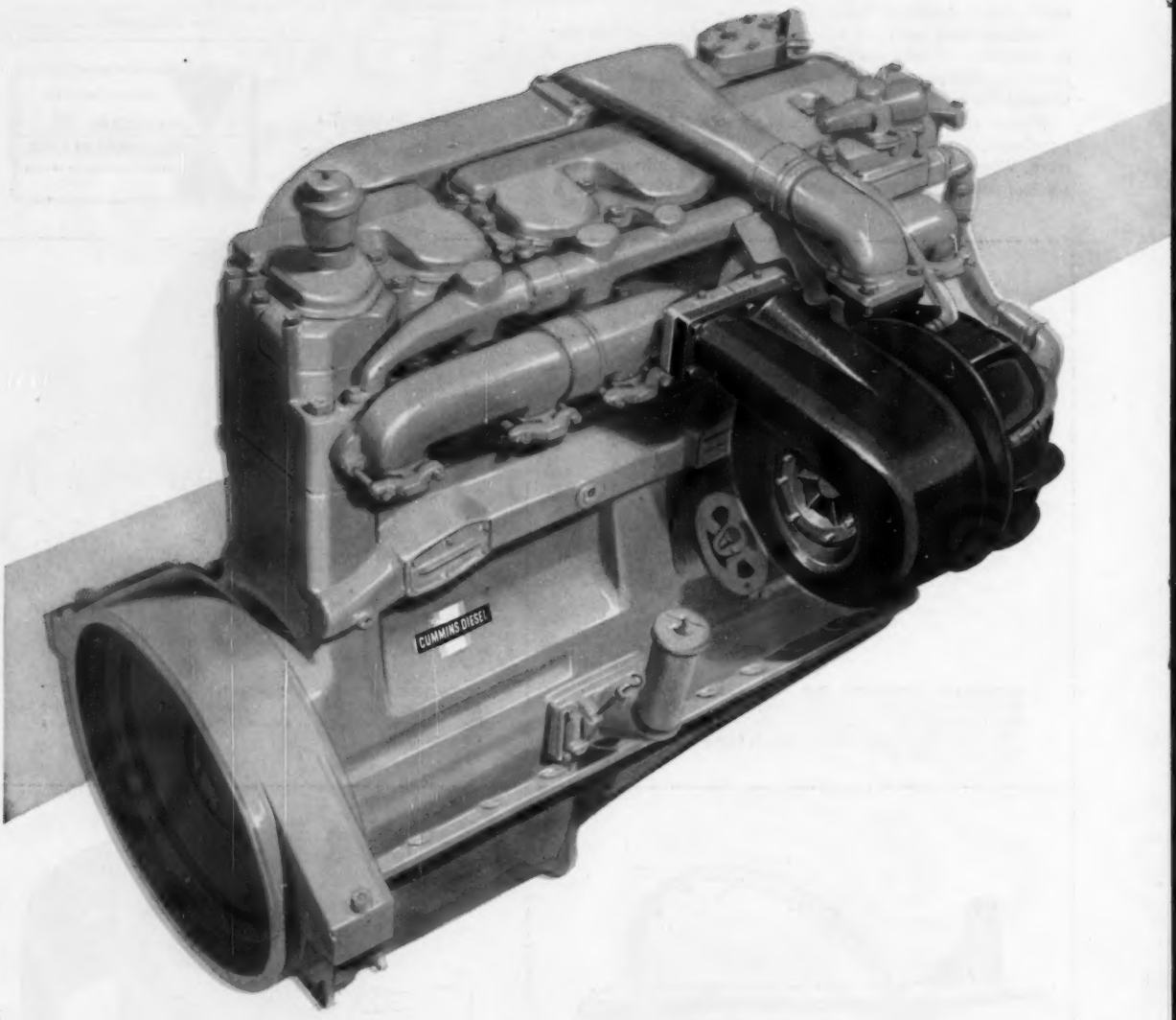


PRATT & WHITNEY—needed a bearing material to withstand the sliding action of steel on their cam bearing. They used a solid aluminum bearing with excellent scuff resistance—saved 65 per cent weight—got better bearing performance.

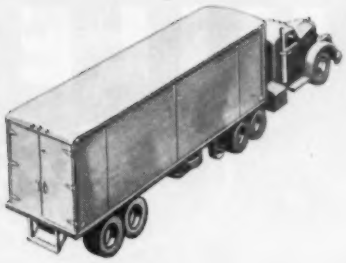


INGERSOLL-RAND CO.—specified full floating bearings of solid Alcoa Aluminum for main connecting rod and thrust bearings. Results: longer life and lower cost than steel-backed babbitt, no spoiled cranksnafts.

NEW *TURBODIESEL*



BY CUMMINS



ups your performance

and lowers your costs!

Cummins 235 h.p. turbocharged NT-6 pulls full loads faster, permits higher speeds on grades, cuts running time, because it produces greater horsepower without increase in engine size or displacement. Turbocharging—which harnesses exhaust gases normally wasted—produces this extra horsepower by achieving a more perfect air-fuel mixture in the combustion chamber.

In addition, Cummins exclusive PT fuel system is simple and trouble-free . . . makes fuel system maintenance costs negligible. It is so easy to understand and work with that no specialists are needed. Fuel costs, of course, are kept at a minimum with No. 2 diesel fuel or furnace oil.

For the operator of Cummins 200 h.p. NH-600 models, a Turbodiesel Conversion Package will soon be available which will make it possible to add 35 h.p. to every unit. For further information, see the Cummins distributor in your area, or send us this coupon today.

Turbodiesel Conversion Package for NH-600 models includes turbocharger, new manifold, and gaskets.

CUMMINS

Cummins Engine Company, Inc.
Columbus, Indiana

Leader in rugged, lightweight, high-speed diesels (60-600 h.p.)

Cummins Engine Company, Inc.
Columbus, Indiana

Please send me detailed information on the Cummins developments checked below:

_____New NT Turbodiesels

_____Turbodiesel Conversion Package for NH-600 models.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

DI-4

SENSATIONAL MILEAGE

STOPS! RING GROOVE WEAR

Double Bonded

METALLURGICALLY Al-Fin Bond

MECHANICALLY Zollner Lock

ZOLLNER

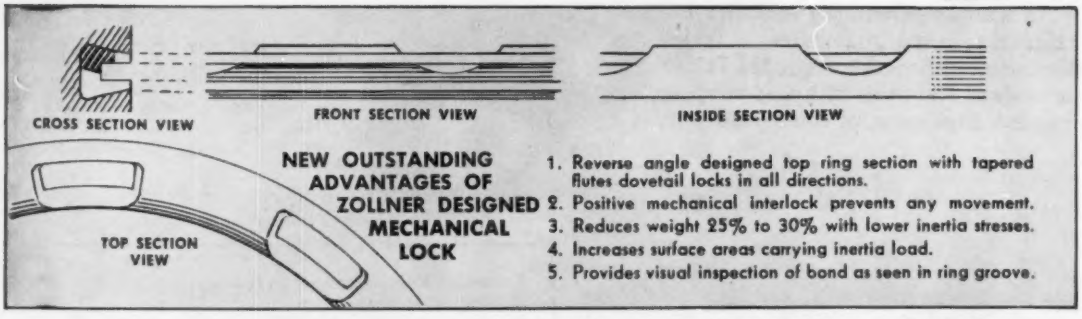
"Ni-Resist" Iron Top Ring Section

BOND LOC*

For Extra Heavy Duty Service

PISTONS

Up to 5 times more mileage is typical of this great new piston development by Zollner engineers. Designed for the most severe service, the BOND-O-LOC Piston has a "Ni-resist" iron top ring groove section *permanently* incorporated by *both* Al-Fin metallurgic bond and the exclusive Zollner mechanical lock. Separation failure is impossible. Reverse angles on every surface joining the "Ni-resist" iron section provide a multiple dovetail bond which is infinitely wedge-locked. Ring groove wear problems are eliminated, blow-by prevented, oil consumption reduced, mileage between overhauls greatly increased. Many heavy duty engine builders have already tested and approved BOND-O-LOC advantages. Request complete information, now.



NEW OUTSTANDING ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK

1. Reverse angle designed top ring section with tapered flutes dovetail locks in all directions.
2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.
5. Provides visual inspection of bond as seen in ring groove.

Licensed under Patents 2,396,730; 2,455,457; 2,550,879 * T. M. Reg. Pat. App. For

- ADVANCED ENGINEERING
- PRECISION PRODUCTION

in cooperation with engine builders

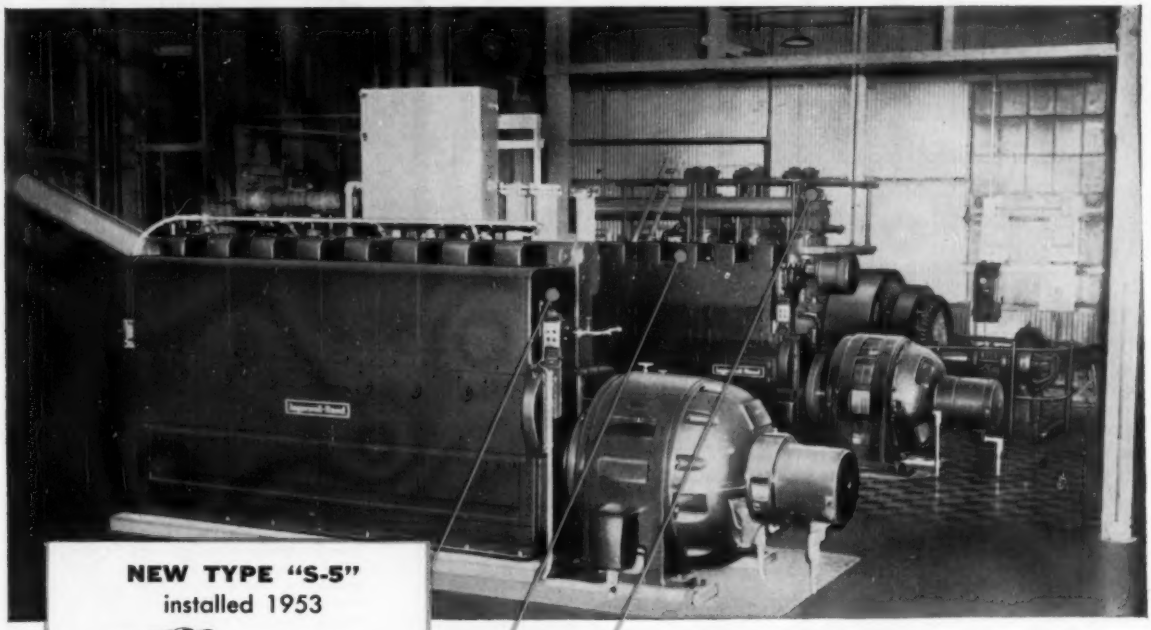
ZOLLNER PISTONS — **THE ORIGINAL EQUIPMENT PISTONS**

ZOLLNER

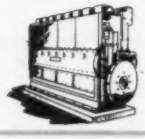
ZOLLNER MACHINE WORKS • Fort Wayne, Indiana

THREE "GENERATIONS"

of I-R Diesels supply dependable power in Central America



NEW TYPE "S-5"
installed 1953

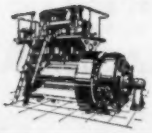


600 hp
8 cylinders
720 rpm

ORIGINAL TYPE "S-3"
installed 1946

450 hp
6 cylinders
720 rpm

OLD TYPE "PR"
installed 1929



170 hp
3 cylinders
300 rpm

. . . all three units in daily service at Cerveceria La Constancia, Central America's leading brewery

Here, in the power generation room at Cerveceria La Constancia, one of Latin America's largest and most up-to-date breweries, we see three "generations" of Ingersoll-Rand 4-cycle diesels — representing 29 years of dependable service.

The old "PR" unit, one of the first solid-injection diesel engines pioneered by Ingersoll-Rand, is still working shoulder-to-shoulder with an early Type "S" unit and a new Type "S" engine which represents the last word in modern diesel design.

This continuous service record is typical of I-R diesels the world over. Their low fuel consumption and exceptional dependability are continually setting the highest standards of performance and economy. Your nearest Ingersoll-Rand engineer will be glad to tell you more about compact, heavy-duty I-R diesels — built in sizes from 200 to 1000 hp. Ask for your copy of Form 10,040.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

7-159

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

SOLVE vibration • movement • expansion problems

SIMPLIFY offset connections

REDUCE maintenance ...in diesel exhaust, air, oil and water piping

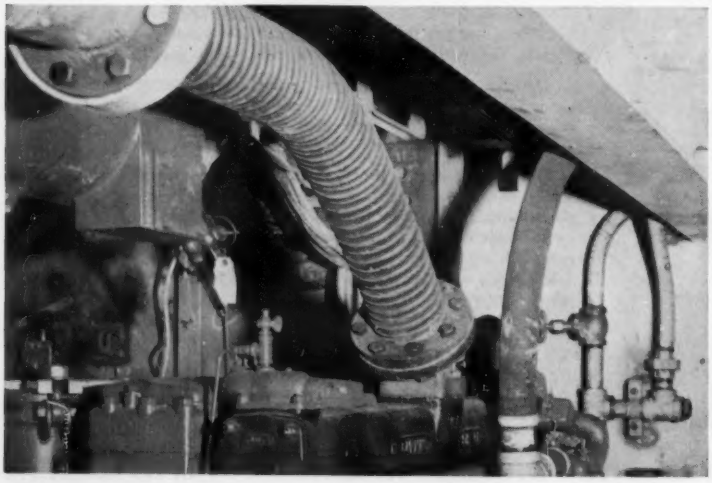
In diesel engine piping systems, American flexible metal hose offers a practical solution to problems of vibration and expansion, the principal reasons for accelerated failure of rigid pipe. It's simpler to install, too. You *bend* it into position, saving time on the job and making easy work of fitting offset connections.

For heavy-duty exhaust and air intake lines, specify American Flexible Steel Corrugated Hose. It adjusts to expansion and dampens engine vibration, preventing excessive stress on exhaust manifold flange bolts and fittings. Vibration dissipates in the hose and is not transmitted to adjacent structural members. Assemblies are supplied complete with floating flanges to simplify lining up with companion flanges.

To convey air, oil and water, use American Seamless Flexible Metal Tubing. Made in bronze or carbon steel for standard service, and in stainless steel or Monel for special service. Tubing has woven wire braid covering for added strength. Complete assemblies include fittings.

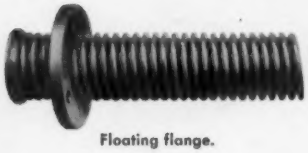
55190

Below: Flexible, corrugated steel hose carries hot diesel exhaust gases to atmosphere.

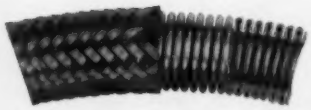


Type Y-10 flexible, corrugated exhaust hose assembly with floating flange, left, and fixed flange. ID's 2" through 16".

Type Y-10 hose with welded nipple, supplied with or without flange.



Floating flange.



Type S-1 braid-covered seamless flexible metal tubing for air, oil and water lines. Seamless tubing is 100% tight and extremely flexible. ID's ⅛" through 12". Usually furnished with fittings attached.

WANT MORE INFORMATION? Bulletin EH-50 gives detailed engineering data on American flexible metal hose and tubing for diesel engines. We'll be glad to send you a free copy, or have one of our sales engineers call. No obligation of course. Address *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.* In Canada: *The Canadian Fairbanks-Morse Company Ltd.*

WHEREVER CONNECTORS MUST MOVE

AMERICAN

FLEXIBLE METAL HOSE AND TUBING

AN

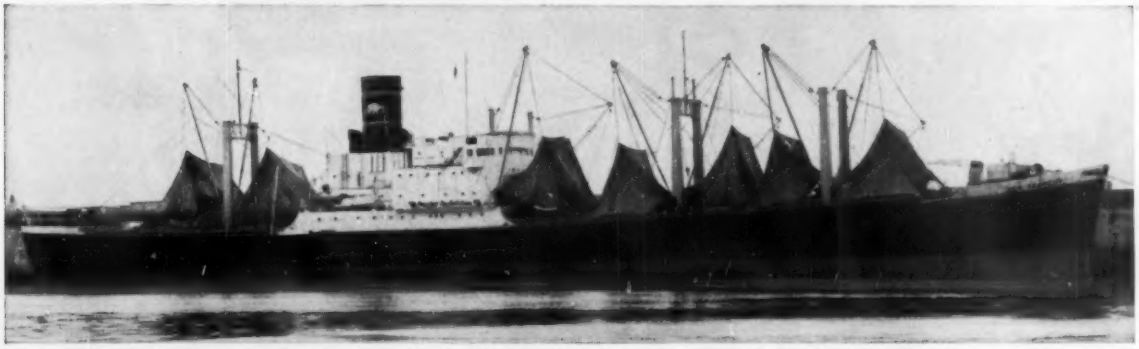
ANACONDA®

PRODUCT

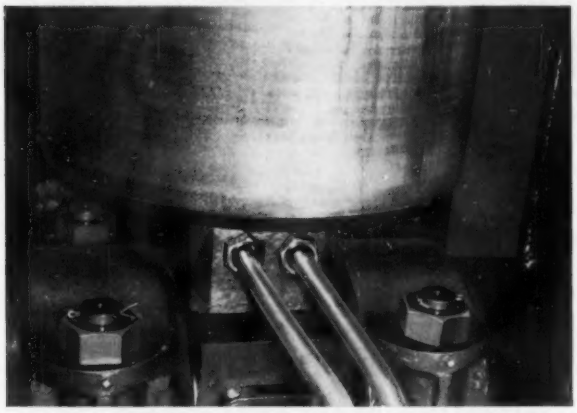
The Engineer's Report

CASE HISTORY
PRODUCT *RPM Delo Marine Lubricating Oil*
FIRM *Pacific Far East Lines, Inc., San Francisco*

New lubricating oil cuts costs on motorships!



RPM DELO Marine Lubricating Oil, a new detergent-type oil, lubricates the big Sun-Doxford diesel propulsion engines in Pacific Far East Line's M.V. Sea Serpent. Especially developed for cylinder and bearing lubrication in high-output, low-speed marine diesels, this special oil minimizes the problem of deposit formation in engines. It keeps them cleaner even where the heavier residual fuels are used. Special compounding in RPM DELO Marine Lubricating Oil inhibits engine deposits, helps keep lacquer off cylinder liners and reduces wear. Records from actual operations show that this oil can cut maintenance costs on big diesels up to 30% and greatly reduce oil consumption. RPM DELO Marine Lubricating Oil is available in viscosity grades SAE 30, 40 and 50.



AVAILABLE IN MANY PORTS. RPM DELO Marine Lubricating Oil is stocked for ship operators in all principal ports throughout the nation.

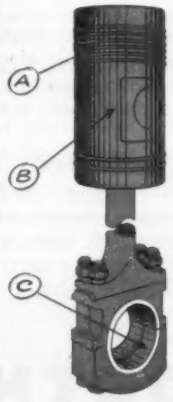
Standard Marine Fuel and Lubricant Engineers are stationed in the following ports: Seattle, Portland, San Francisco, Oakland, and Los Angeles Harbor area. They will give ship operators expert help at any time.

FOR MORE INFORMATION about RPM DELO Marine Lubricating Oil or other petroleum products, or the name of your nearest distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

How RPM DELO Marine Lubricating Oil keeps engines clean and prevents wear

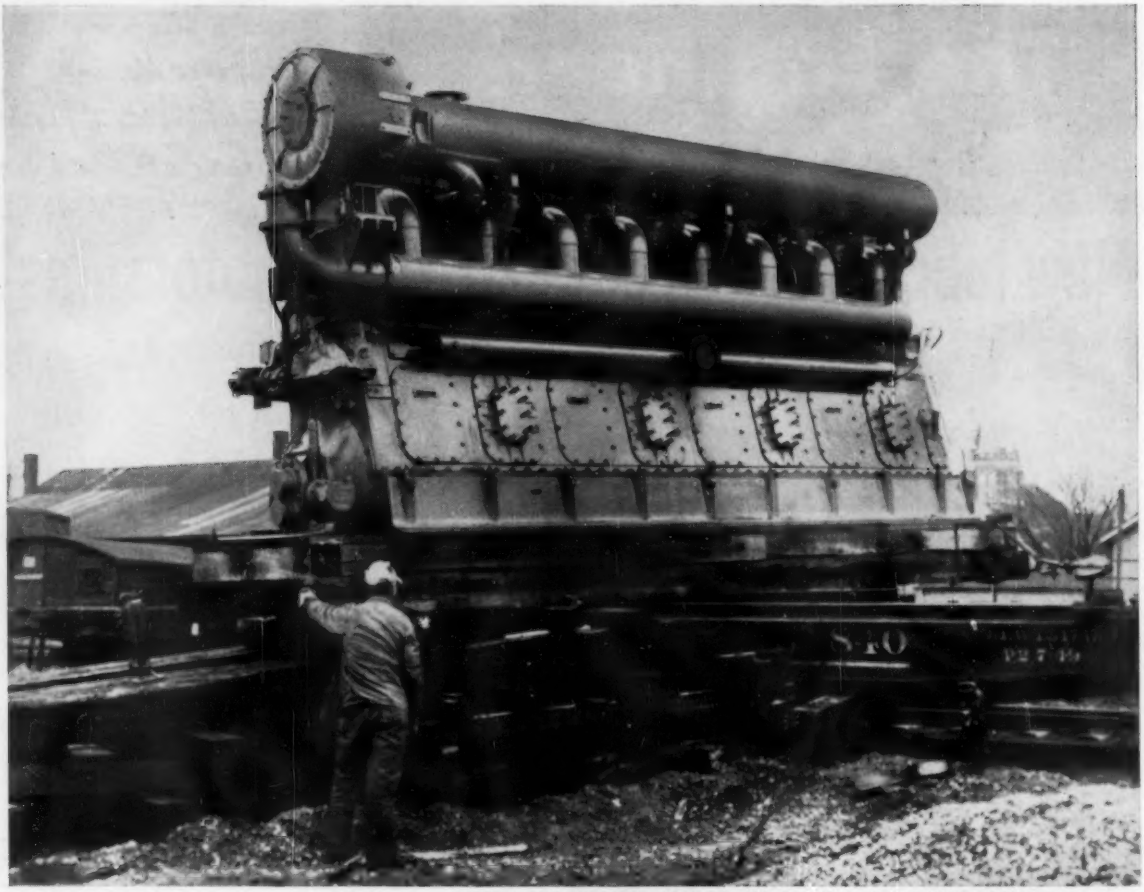


A. Highly effective compounding inhibits deposits...solves residual fuel carbon problems in low-speed marine diesels ...cleans dirty engines, keeps new engines clean, helps prevent scuffing.

B. Special anti-oxidant additive resists formation of lacquer and prevents ring-sticking. Film stays on parts whether hot or cold, running or idle.

C. Corrosion and foam inhibitors stop bearing corrosion, prevent foaming in wet or dry sump engines.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado



FOURTH WORTHINGTON ENGINE to be installed at the Aitkin, Minnesota, municipal power plant. Every Worthington engine is shipped as a complete unit, factory-tested and ready to be installed by Worthington experts.

No field assembly problems here

When Aitkin, Minnesota, ordered its latest Worthington Diesel engine for its municipal power plant, Aitkin's engineers knew that they were going to get a complete, factory-tested power package, ready to be placed on foundations.

This new SEH-8 1760 hp supercharged Diesel brings the Worthington total at Aitkin to four engines. Repeat orders over a period of seventeen years make this a 100% Worthington installation, with the exception of two air-injection units used for stand-by service. Worthington's engineering help in piping and plant layout has also played an important part in increasing efficiency throughout the entire plant.

Power plant men everywhere agree that when you buy a heavy-duty engine that's completely assembled and tested before shipment, you'll save yourself a lot of unnecessary trouble. And you can rely on Worthington's skilled installation engineers to help you get the most out of your power plant.

Write for Bulletin S-500-B52A. Worthington Corporation, Engine Division, Section E.4.4., Buffalo, N.Y. E.4.4

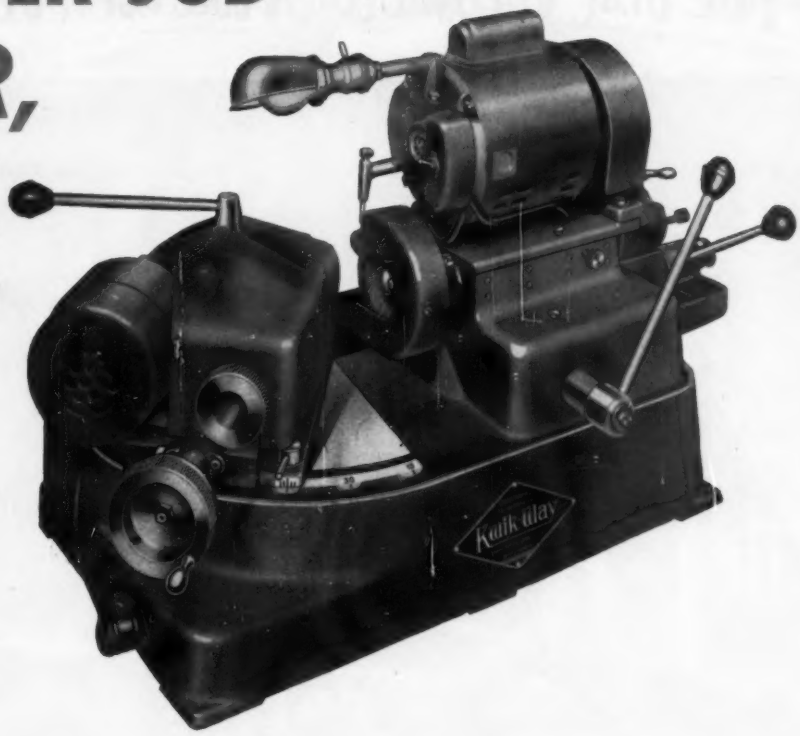
"SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street."

WORTHINGTON

Economical Continuous Power — *Diesels, Oil and Dual Fuel, and Spark-Ignition Gas Engines, from 190 to 2100 bhp.*

A BETTER JOB FASTER, EASIER

with the NEW KWIK-WAY *Super-Matic* Valve Facing Machine



This outstanding new valve facing machine makes it easy to obtain extreme accuracy and superior finish, with smooth, simplified operation. For better valve facing work, the answer is Kwik-Way's Super-Matic.

- extreme accuracy
- superior finish
- smooth, easy operation
- Micro-switch operating controls
- precision built, lever operated, 6-ball compound chuck
- chuck capacity 7/32" to 3/8"
- improved coolant system
- extra power with dual motors
- dove-tailed, handscraped ways with adjustable gib
- pre-lubricated, sealed bearings on grinder spindle
- rugged construction. Built to highest standards for fine machine tools.

See and operate the Super-Matic in your shop. No obligation.
Call your Kwik-Way representative for a free demonstration.

MAIL THIS COUPON TODAY

Kwik-Way

Serving the Motor Rebuilding Industry Since 1920

VALVE FACING MACHINES • VALVE SEAT GRINDERS • VALVE SEAT INSERT TOOLS • VORTEX SUCTION DEVICE CYLINDER BORING MACHINES • LINE BORING MACHINES • PISTON CAM TURNING AND GRINDING MACHINES.

CEDAR RAPIDS ENGINEERING CO.
918 17th St., N.E., Cedar Rapids, Iowa

Tell me more about this remarkable new valve facing machine.

☐ Send literature.
☐ Have your representative come in and demonstrate the Super-Matic--at no cost or obligation.

Name_____

Company_____

Street_____

City_____ State_____

The best locomotives are even better today!

Seventeen 1750-Horsepower GP9's Delivered to Grand Trunk Western

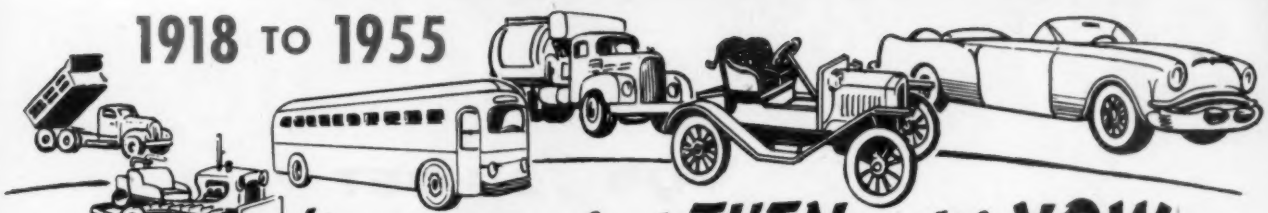
The Grand Trunk Western Railway's new GP9's have 17% more horsepower than earlier models—can haul more tons on today's schedules or the same loads on faster schedules.

General Motors Diesel locomotives are the favorite of railroads because they give a better return on investment—pay for themselves out of savings in five years or less! One reason is lower-cost maintenance. For example, parts for GM Diesel locomotive engines cost from 25% to 50% less than similar parts for other Diesel locomotive engines.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

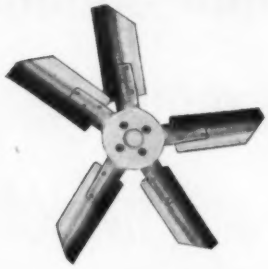
GENERAL MOTORS LOCOMOTIVES

La Grange, Illinois • Home of the Diesel Locomotive • In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario

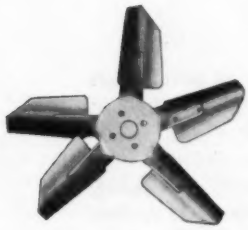


from away back **THEN** *until* **NOW**

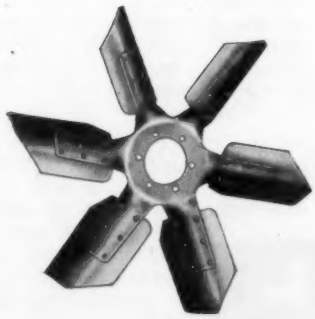
SCHWITZER-CUMMINS
Specialists in COOLING FANS



Heavy Duty Truck Fan



Extra Cooling
Passenger Car Fan



Heavy Duty Bus Fan

Shown Here **are samples of many fine cooling fans with individual characteristics compounded for best performance of the engine and engineered, developed and manufactured in Schwitzer-Cummins plants and laboratories for blue-ribbon engines in the automotive world.**

The founders of Schwitzer-Cummins Company were consultants on engine cooling in the pioneering days of the automobile. Then, with the formation of the company 36 years ago, became active as manufacturers of cooling fans and water pumps and qualified immediately as major suppliers to the then young automotive industry.

During this long stretch, a world of experience in fan design, application and manufacture has become centered in our fan division. Thousands of tough problems have been solved for our customers and much creative engineering has given the industry many "firsts" while manufacturing facilities have kept ahead of the times and remained unsurpassed for low production costs and precision work.

We are complete to develop and produce fans in an extensive variety of shapes, sizes, materials for virtually all purposes, automotive and stationary.

May we work with you on your next cooling fan requirement?

Passenger Car Fan

Light Truck Fan

Other Products

- EXHAUST DRIVEN TURBOCHARGERS
- SUPERCHARGERS (POSITIVE DISPLACEMENT)
- CRANKSHAFT VIBRATION DAMPERS
- WATER PUMPS
- OIL PUMPS
- AUTOMATIC SHAFT SEALS
- AIR STARTING MOTORS
- THERMOSTATICALLY CONTROLLED FAN DRIVES

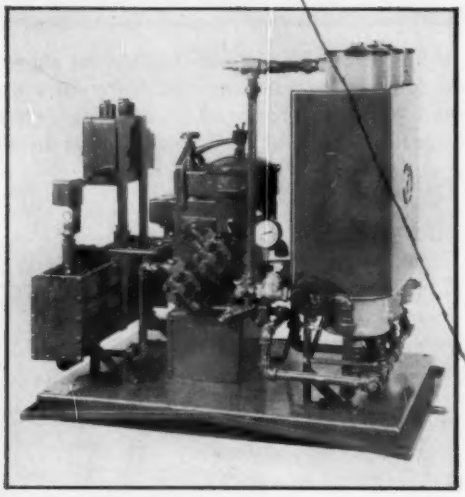
Air Starting Motors and Thermostatically Controlled Fan Drives manufactured for and sold exclusively by the Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio.

SCHWITZER-CUMMINS COMPANY

1125 MASSACHUSETTS AVENUE • INDIANAPOLIS 7, INDIANA

Specialists in Automotive Cooling for Over a Third of a Century

DO YOU GET ALL THE "ENDURANCE VALUE" OUT OF YOUR DIESEL LUBE OIL?



The refiners of your engine lubricating oil gave it high "endurance value" . . . continued stability and resistance to breakdown . . . long-lasting wetting ability . . . film strength . . . adhesion.

Keep *all* the value they put into the oil . . . by keeping it clean and dry . . . with a *De Laval* Diesel Oil Purifier.

De Laval provides maximum protection for your diesels. There is a type and size to fit every installation . . . to keep oil *clean* . . . keep it *dry* . . . day after day, month after month, year after year!

DE LAVAL

lubricating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5

Mechanic and Helper* remove Piston in Record Time

20,000 people at the New York Boat Show tried to guess how long it would take to pull a piston on a standard production model Opposed Piston Diesel.

Starting from scratch, the piston was removed and on the floor—in just two minutes flat!

Why was it possible in just two minutes? There are no gasketed joints to separate—no lube or fuel oil connections to break—no water connections to break—no cylinder heads to remove. That's why, in two minutes, you can do on an O-P what it takes hours—even days—to do on comparable diesel engines.

There's more—much more—to the story of what Repowering with O-P can mean to your maintenance operations and profit. Why not get together with your nearby F-M Marine Specialist and find out about the profitable difference with O-P Power? Fairbanks, Morse & Co., Chicago 5, Illinois.

*TV Actress Joan Kemp

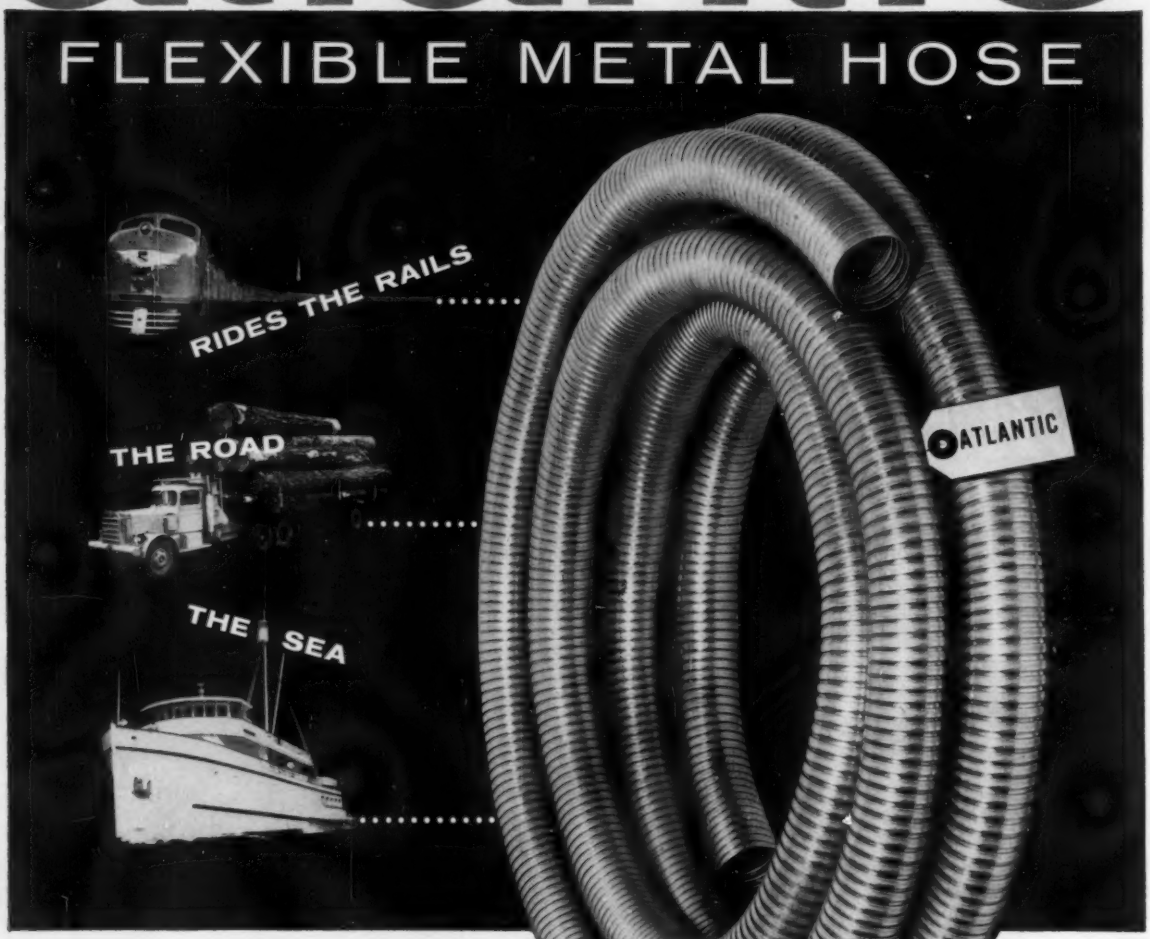
FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

atlantic

FLEXIBLE METAL HOSE



When diesels power trucks hauling 70,000 lb. loads of logs over mountain roads — or locomotives and ships, Atlantic flexible metal hose is usually given the job of guarding those vital diesel life lines—water, fuel, exhaust.

Atlantic flexible metal hose is manufactured to tough specifications.

Wall thickness is absolutely uniform. Tight against water, oil, steam, gas and air. Requires no maintenance. Atlantic flexible metal hose dampens vibration, remains flexible at higher temperatures.

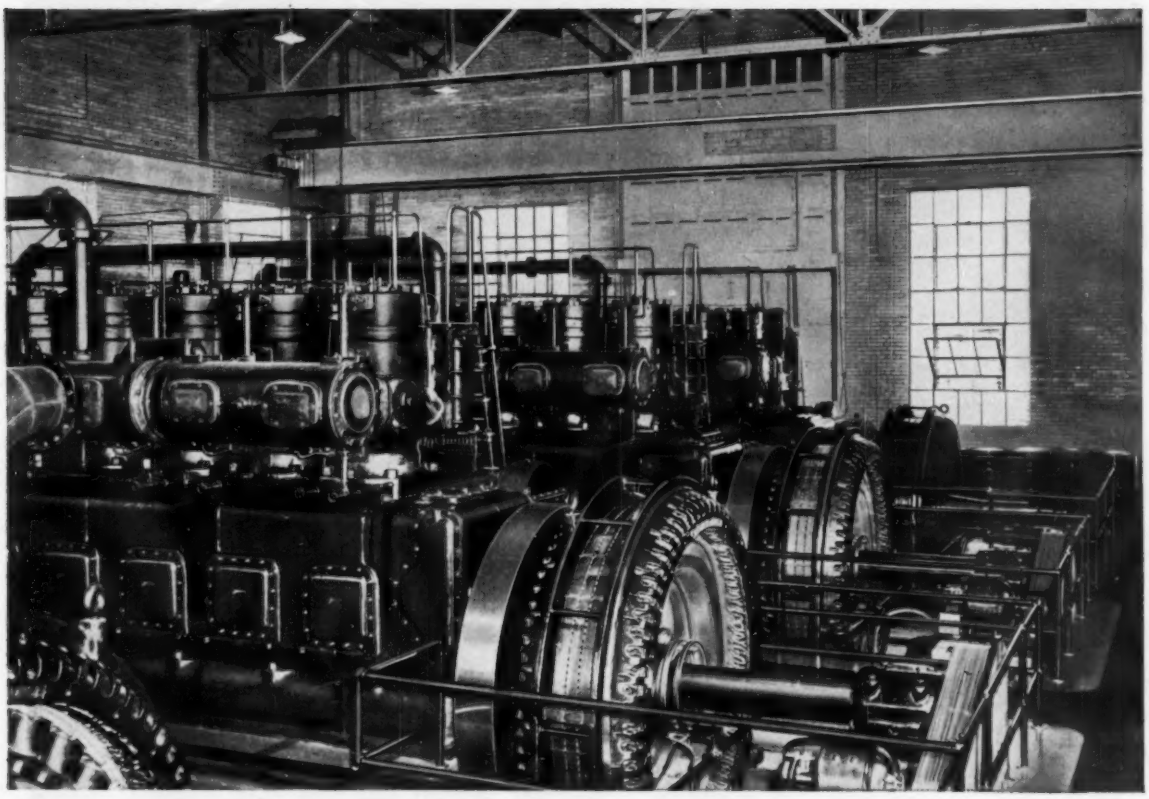
There is an Atlantic flexible metal hose for each of these applications. Made in bronze, steel, stainless and monel—⅛"-36" I.D. with required fittings.

For misalignment and vibration

Write for Diesel Bulletins 1020 & 50A. See our Catalog in Sweet's Product Design File.

ATLANTIC METAL HOSE CO., INC.

309 DYCKMAN ST., NEW YORK 34, N. Y.



"We're Proud of This Plant!"

says Don H. Decker, — Plant Supt., Thumb Electric Cooperative, Ubly, Mich.

Manager Orville Hurford and Mr. Decker are justifiably proud of their 4-diesel engine generating station. The plant has been an outstanding financial success since the day it was first opened. Several times it has occupied #1 position on the REA Running Plant capacity chart.

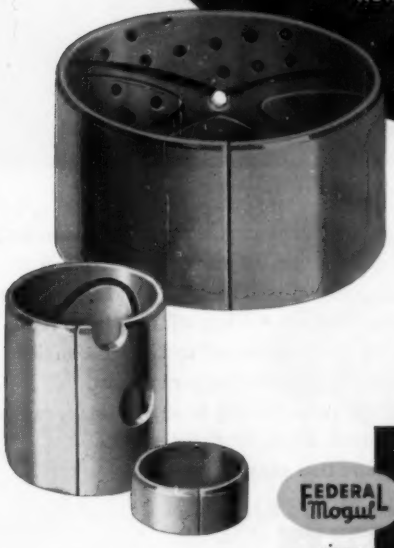
Mr. Decker writes, "A large part of our operating success we attribute to Sinclair GASCON® D oil. It has given us an excellent rate of consumption while reducing wear. In fact, *cylinder and piston ring wear is much below normal based on other plants of equal capacity*. Something else we appreciate is the timely visits of the Sinclair Lubrication Engineers."

Top quality lubricants plus the assistance of Sinclair Lubrication Engineers are two of the reasons why Sinclair can play a large part in the success of *your* operation. Your local Sinclair Representative will be happy to explain the remaining reasons. Phone him or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save Wear and Replacement

SINCE 1864
DEUTZ
Diesel
3-2000 H.P. air and water-cooled
for Road vehicles, Rail vehicles,
Watercraft, Working machines ·
Marine engines also direct reversing
for all waterways · Dieseltrac-
tors 11·15·22·30·45·60
H.P. Diesellocomoti-
ves · Generator sets
air and water-cooled
for lighting current
and power stations
stationary and mobile
KLÖCKNER-HUMBOLDT-DEUTZ AG · KÖLN
Address inquiries from U.S.A., Alaska, Hawaii and Puerto Rico to: DIESEL ENERGY CORPORATION,
82 Beaver Street, New York 5, N. Y. Certain territories open for distributors.



Rolled, split bushings, bimetal or plain, are real money savers. Bimetal bushings give bearing performance at bushing costs for many applications. Plain bushings save money in hundreds of uses from business machines to bicycles. Both types available in a wide variety of sizes, with oil holes, grooves, notches, windows, straight, lock or special seams. Quality control. Engineering service.

FEDERAL-MOGUL CORPORATION, 11041 Shoemaker, DETROIT 13, MICHIGAN

FEDERAL Mogul
since 1899

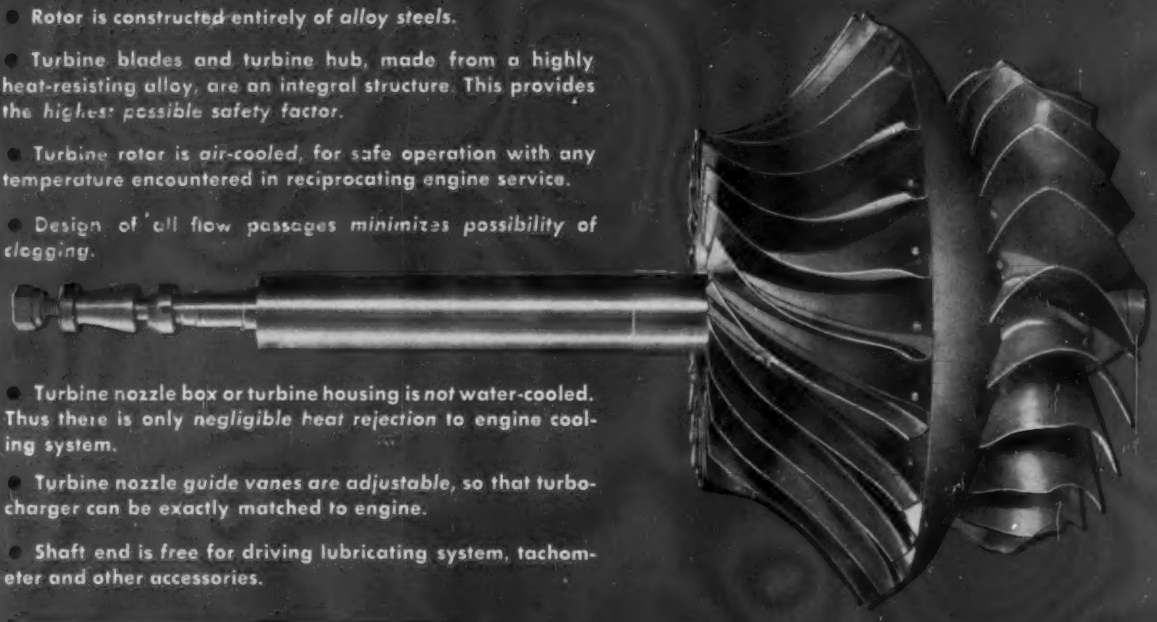
FEDERAL-MOGUL

Also sleeve bearings in many designs and sizes; cast bronze bushings; washers, spacer tubes, precision bronze parts and bronze bars.

DE LAVAL
HIGH PRESSURE TURBOCHARGERS

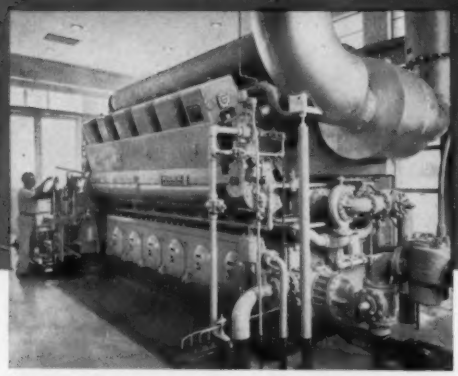
increase output by 100% or more

- Rotor is constructed entirely of *alloy steels.*
- Turbine blades and turbine hub, made from a highly heat-resisting alloy, are an integral structure. This provides the *highest possible safety factor.*
- Turbine rotor is *air-cooled,* for safe operation with any temperature encountered in reciprocating engine service.
- Design of all flow passages *minimizes possibility of clogging.*

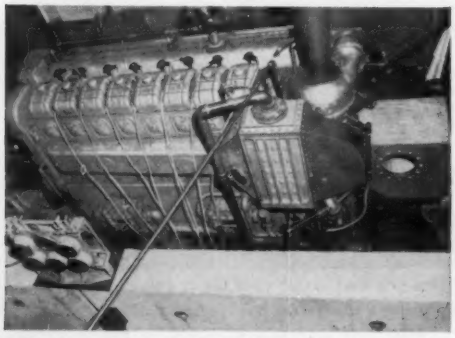


- Turbine nozzle box or turbine housing is *not* water-cooled. Thus there is only *negligible heat rejection* to engine cooling system.
- Turbine nozzle *guide vanes are adjustable,* so that turbocharger can be exactly matched to engine.
- Shaft end is free for driving lubricating system, tachometer and other accessories.

Exclusive
MONOROTOR
construction shows why



Here is a De Laval Type A-14 Turbocharger installed on a V 12-cylinder, 4-cycle diesel engine.



A De Laval Type B-8 Turbocharger, shown on test, is mounted vertically on an 8-cylinder, 2-cycle diesel.

These De Laval high pressure turbochargers represent the newest development in diesel engine design. In many cases they can double the output of heavy-duty diesel, gas and dual-fuel engines without increasing thermal loading. • They offer pressure ratios of 3:1 as well as far higher compressor and turbine efficiencies than those found in conventional turbocharger systems.
• De Laval turbochargers are self-adjusting to engine loads, can be used on 4- *and* 2-cycle engines. *Write for Bulletin 8000* giving compressor curves and flow range diagrams.

DE LAVAL

Turbochargers

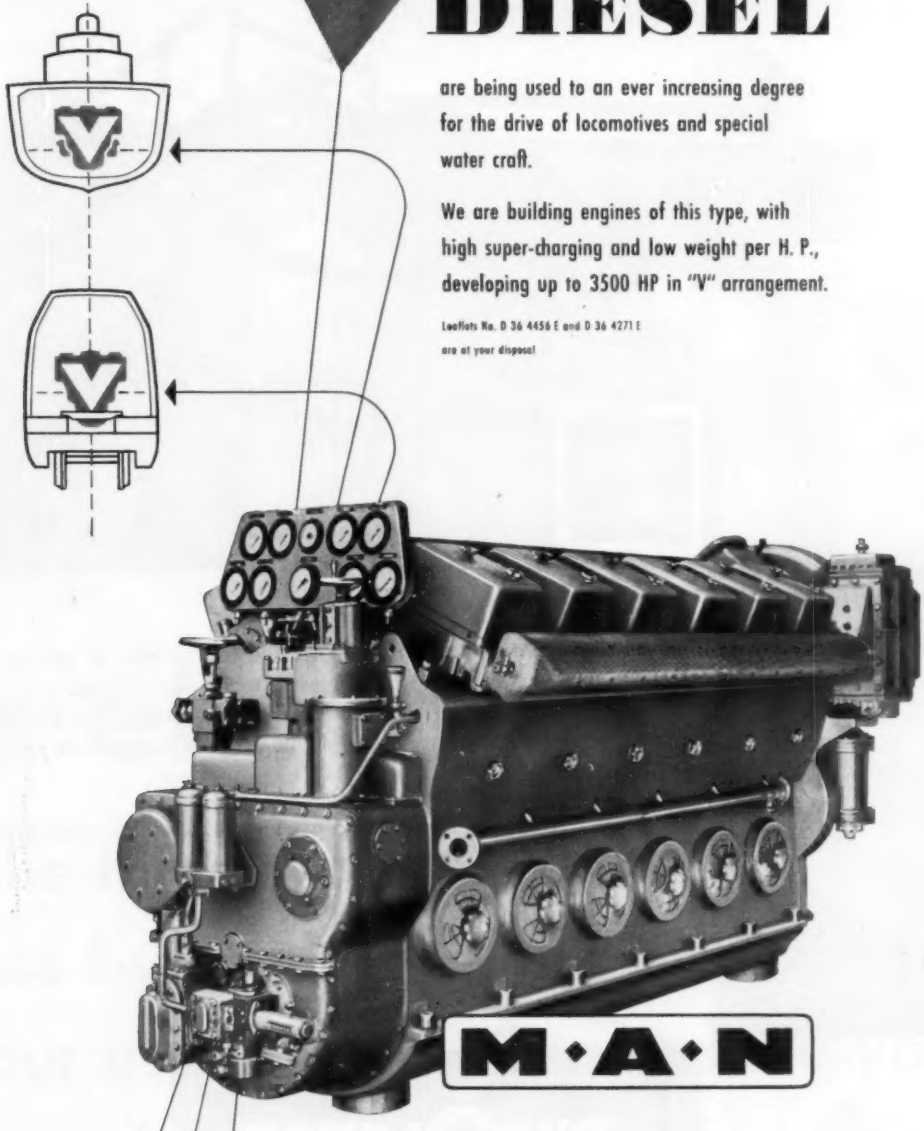
DE LAVAL STEAM TURBINE COMPANY
890 Nottingham Way, Trenton 2, New Jersey

V DIESEL

are being used to an ever increasing degree for the drive of locomotives and special water craft.

We are building engines of this type, with high super-charging and low weight per H. P., developing up to 3500 HP in "V" arrangement.

Leaflets No. D 36 4456 E and D 36 4271 E are at your disposal



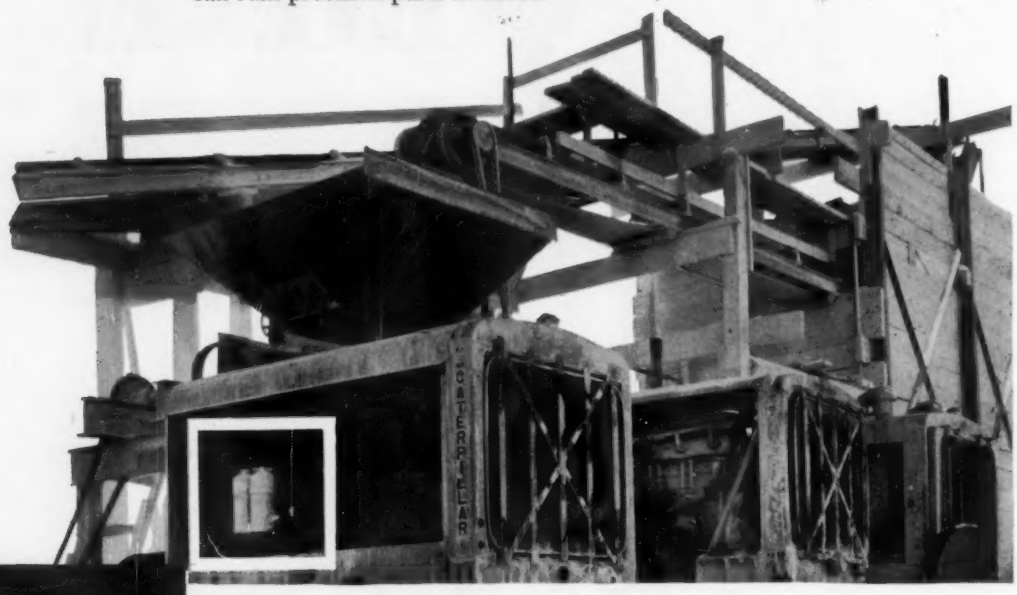
M·A·N

MASCHINENFABRIK AUGSBURG-NÜRNBERG AG · WERK AUGSBURG

We are represented in all countries. Please ask for name and address of your local representative.

are substitute filter refills ruining your engine?

When some "off-brand" or "will fit" oil filter refills are used in a full-flow system, they cannot handle sufficient volume. The by-pass valve opens and pours dangerous unfiltered oil into your engine. This inadequate filtering can ruin precision parts in hours.



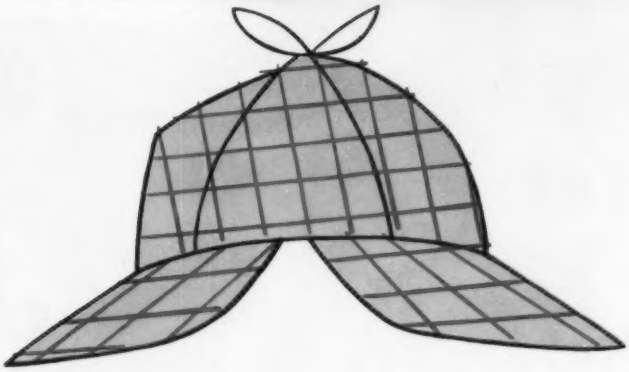
Your Caterpillar dealer knows the importance of giving you only manufacturer-approved replacement filters built to Caterpillar's exacting engineering standards by Purolator. He knows that your engine life depends on it.

Use only manufacturer-approved oil filter refills. They're designed to meet the specific requirements of your equipment.

PUROLATOR

"FIRST IN THE FIELD OF FILTERING"

PUROLATOR PRODUCTS, INC., Rahway, New Jersey and Toronto, Ontario, Canada

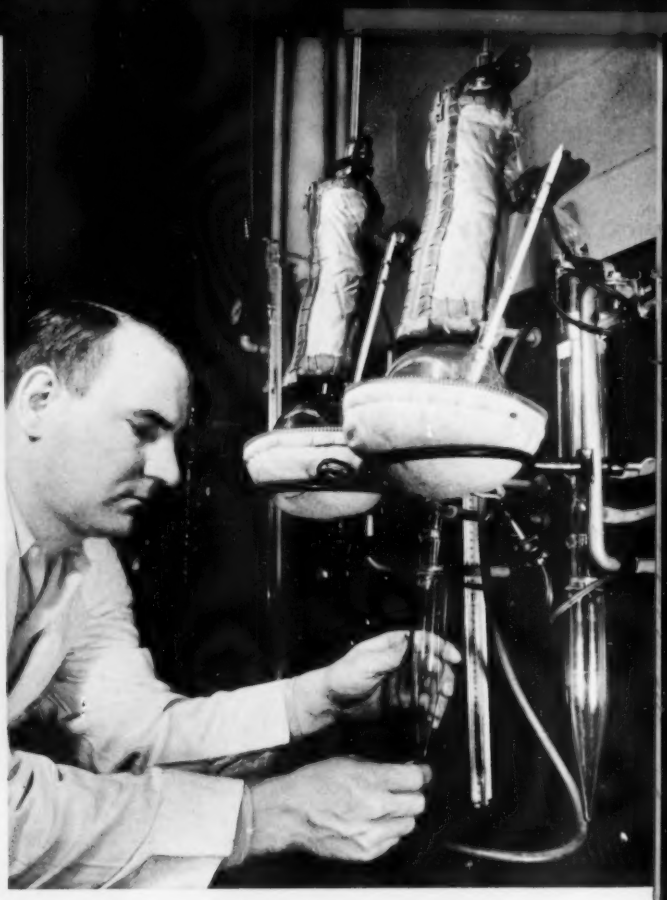


It's elementary...

but the things we can detect about an engine by analyzing one pint of your used motor oil may save you an amazing amount of money!

FREE

Pure Oil service prevents costly engine repair



PURE-SURE USED OIL ANALYSIS DETECTS HIDDEN TROUBLE, KEEPS FLEET UNITS AT TOP EFFICIENCY...

You will be amazed at the information the scientists in our multi-million dollar laboratories at Crystal Lake, Illinois, can get out of one pint of your used motor oil—Many different kinds of information that tell what may go wrong with your engine, what would cause it, and what to do about it *now* to save costly repairs.

Pure Oil offers this valuable service (called Pure-sure Used Oil Analysis) *free* to fleet users of Pure Oil products.

Now, in order to show how valuable this service can be to *your* operation, Pure Oil offers you a *free* Pure-sure Used Oil Analysis for one of your fleet units. There is no obligation. Just call your nearest Pure Oil office or send in the coupon.

PUROL H. D. MOTOR OIL

for sure fleet service and economy

Here's the *sure*, heavy duty motor oil for today's modern fleets. Fully detergent for cleaner engines. High viscosity index means less oil consumption, greater protection in heat and cold. This oil fights rust and corrosion inside your engine.

Use Purol H.D. in your fleet units for low maintenance costs and long, trouble-free service.

The Pure Oil Company, Department *5540*
35 East Wacker Drive, Chicago 1, Illinois

Without cost or obligation, please send me information on how I may obtain a Pure-sure Analysis of my used oil.

Name_____

Title_____

Company_____

Address_____

City_____ **State**_____

This offer must be limited to fleet operators in the 24-state area where Pure Oil products are sold.

SALES OFFICES LOCATED IN MORE THAN 500 CITIES IN PURE'S MARKETING AREA

Be *sure* with Pure

THE PURE OIL PURE COMPANY, U.S.A.

4244

CONTINENTAL

*CUSHIONED POWER DIESELS

29 to 225 HORSEPOWER

MODEL VD8603
CUSHIONED POWER INDUSTRIAL
DIESEL. 182 H.P. @ 2800 r.p.m.

There are three main reasons why Continental's Cushioned Power principle results in higher performance and more efficient operation.

1. Combustion chamber design assures higher turbulence, promotes cleaner burning. All fuel is utilized.

•

2. Operation is smoother. Cushioning of the explosive force results in reduction of noise.

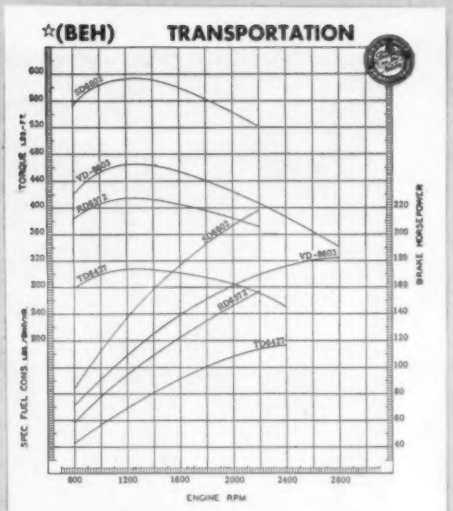
•

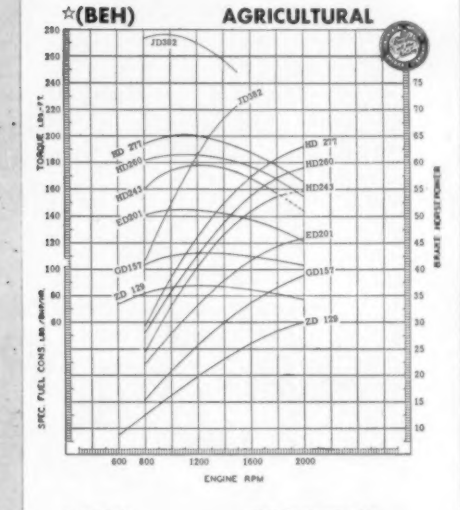
3. Easing of peak forces on rods, shafts, and bearings makes for longer service, with less time out for repairs. By permitting wide interchangeability of parts with Red Seal* gasoline models, it greatly simplifies the job of service in the field.

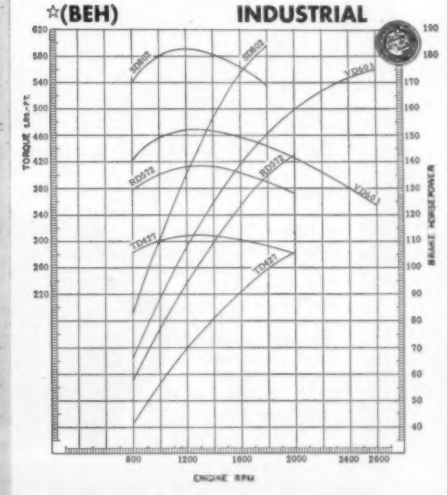
Continental Cushioned Power Diesels are now available for various applications in transportation, agriculture and industry. Write for bulletins and color folder showing how Cushioned Power works.

PARTS AND SERVICE COAST TO COAST

*TM REG.







☆ (BEH) BARE ENGINE HORSEPOWER ZD, JD, HD AND ED MODELS FOR INDUSTRIAL APPLICATIONS ONLY.

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Continental Motors Corporation

MUSKEGON, MICHIGAN

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Steadystate Flow -vs- Blowdown

TURBO-CHARGING SYSTEMS

BOTH turbocharging methods have decided advantages for specific applications.

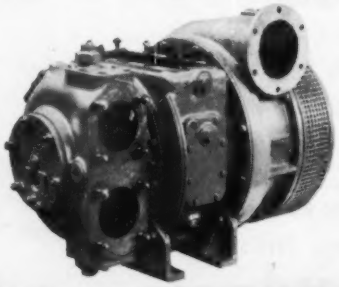
The *Blowdown System* is strictly dependent on the available exhaust pipe volume but permits reaching the required energy necessary to scavenge and to supercharge the engine at lower scavenge pressure. The *Steadyflow System*, though requiring higher scavenge pressures, has the advantage of being applied independently from the turbocharger position in the engine room.

Whichever method is required, Brown Boveri has the engineering and design knowledge as well as the manufacturing "know-how" to supply turbo-chargers which get the MOST *from either system.*

If you have a turbocharging problem, it will pay you to contact BROWN BOVERI. Write for data.

BROWN BOVERI

BROWN BOVERI exhaust gas TURBO-CHARGERS give you ALL these advantages:



A typical Brown Boveri exhaust gas Turbo-Charger. These are available in various sizes for charged outputs from about 100 BHP to 6,000 BHP, 4- or 2-cycle operation.

- **Continuous power increases of 100% or more.**
- **No increase in operating costs since chargers run on exhaust gases from turbines.**
- **40% and more reduction in space and weight per HP of supercharged engine.**
- **Self-contained lubricating system eliminates special oil piping outside the engine.**
- **Air pressure equalization prevents polution of blower wheel and bearings.**
- **Ideal for use at high altitudes, too, since pressures can be increased to that of sea level operation.**
- **Only Brown Boveri offers engineering design and application assistance of internationally recognized specialists in turbo-chargers.**

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. Detroit, Mich. • High Point, N.C. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal. Minneapolis, Minn. • New Orleans, La. • New York, N. Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.

"Engine Cooling System Problems Can Be Prevented" says,

Joe Vittel

Manager—Perry Filter Division
R. M. Hollingshead Corporation

Generally, we overlook the very important fact that a clean cooling system is not an end in itself but rather the means to an end; a guarantee of longer engine life . . . fewer engine breakdowns . . . less maintenance costs.

In the past, most of our attention has been directed to the curing of an already developed "headache" (acute cooling system distress). We remove the trouble and then believe everything is well with the system.

Actually, we are ignoring the fact that the trouble should have been—*could have been*—avoided completely, simply by maintaining a constantly clean cooling system.

To accomplish this, we must realize cooling system trouble is of two kinds: 1.—that caused by water scale, rust, oil and other foreign matters; and 2.—that caused by corrosion—actual chemical and electrochemical destruction of metals. Both cause clogged systems and insulating deposits in critical heat transfer areas ("Heat-wear zones"), and are responsible, in a large degree, for premature overhauls due to worn pistons, rings and liners and distorted valves, seats and stems.

The answer in one small unit, to both kinds of cooling system trouble, is the Perry Cooling System Filter and Conditioner. It gives complete, two-way protection . . . is easily installed . . . and requires a minimum of service—the simple, inexpensive replacement of a chemically activated element.

It has won the enthusiastic approval of most leading engine manufacturers.

We guarantee this: Correctly installed on any new engine, and properly serviced, the Perry Filter and Conditioner will keep the cooling system clean and eliminate a major cause of costly breakdowns —on old engines the Filter will gradually clean the system and reduce the cost of upkeep.

Write me at the Perry Filter Division for the full story on the Perry Filter, and the names of local Perry users, or see your local Perry representative.

Great Southern Trucking says:

"Block cracking eliminated . . . longer life between overhauls with Perry Cooling System Filters"

Today, all of Great Southern's fleet (upward of 500 power units) is Perry Filter protected. Here's why this top flight trucking concern took this special step.

A large portion of Great Southern's power is in lightweight tractors to meet local state weight restrictions. Running this light equipment on rigidly tight schedules produced a high incidence of cracked blocks. Maintenance investigations showed the fundamental trouble was engine overheating . . . cooling systems were not functioning properly despite frequent periodic check-ups.

To combat a growing number of cracked blocks, D. D. Hodges, System Maintenance Superintendent, authorized purchase of Perry Cooling System Filters for his lightweight power.

Block cracking was eliminated! The Perry Filter kept the engine cooling system permanently clean. There was no more overheating—no more cracked blocks. The amount of repair was substantially cut. These savings justified the use of Perry Filters on the rest of the Great Southern fleet. All new power, including a recent purchase of ten West Coast Internationals, is now equipped with Perry Filters before going on the road.

This is a strong testimonial from one of America's largest and most efficiently run trucking concerns. For the same economies in maintenance and service, investigate Perry Cooling System Filters for your gasoline and diesel powered engines. A *permanently* clean cooling system saves time, money and trouble.

PERRY FILTER DIVISION
R. M. Hollingshead Corporation • 840 Cooper Street, Camden 2, New Jersey

ELECTRO-CHEMICAL
Perry
COOLING SYSTEM
filter
and CONDITIONER

Mail this coupon for full information.

Perry Filter Div., R. M. Hollingshead Corporation
841 Cooper St., Camden 2, New Jersey

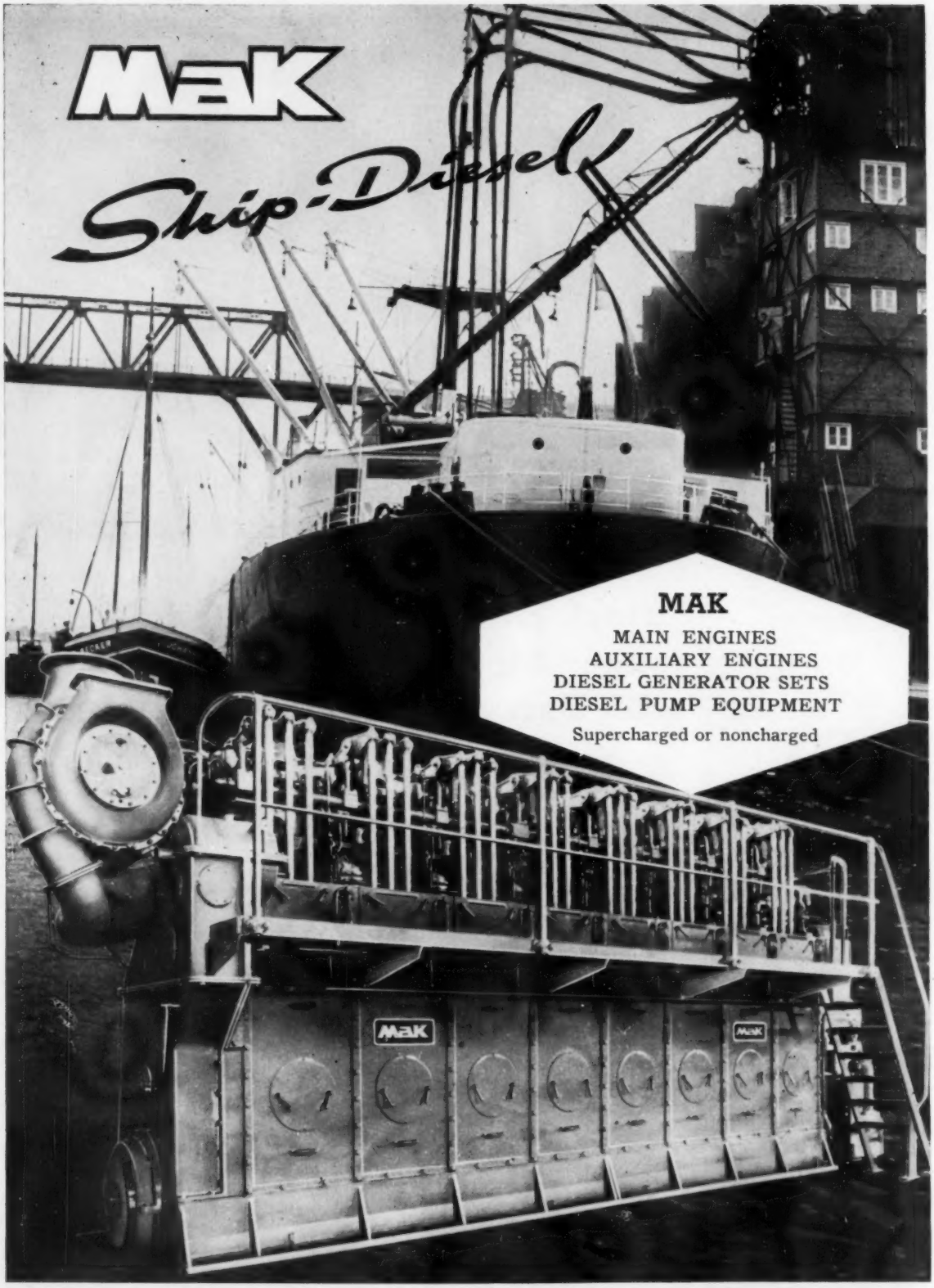
Please send complete information on the Perry Cooling System Filter and Conditioner.

Name_____

Firm_____ Position_____

Address_____

City_____ Zone____ State_____

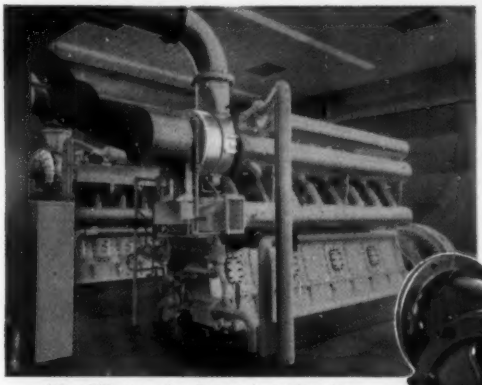


We will exhibit Diesel Locomotives, "At the German Industries Fair Hannover", in the Open Air Area Essener Strasse, block D, stand 406, from April 24 through May 3, 1955.

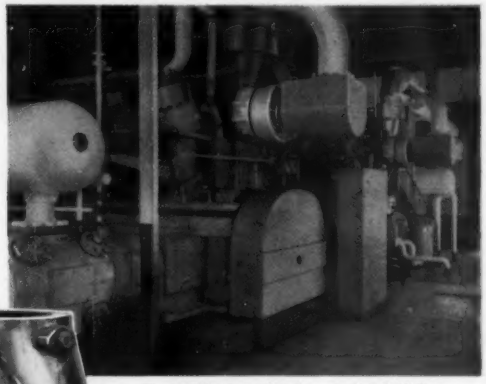
MASCHINENBAU KIEL AKTIENGESELLSCHAFT

GERMANY

You can count on ELLIOTT turbocharging!

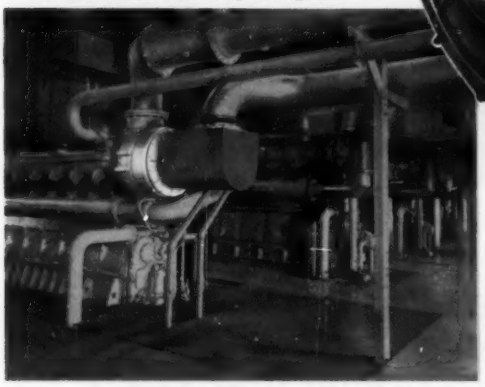


The Elliott turbocharged engine in the foreground is a recent addition in this municipal plant. Earlier Elliott model in background.

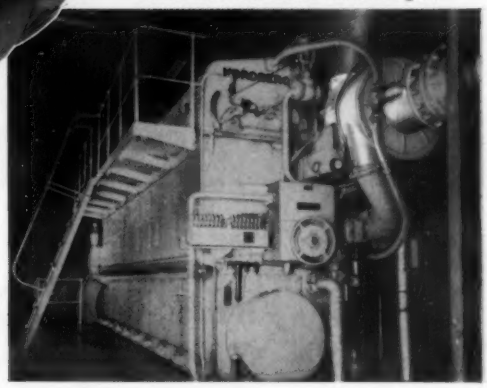


Two Elliott turbocharged 1350-hp engines on the job in a natural gas company pipe line station in the Southwest.

Elliott turbocharger in modern municipal plant. In the rear are three other Elliott turbocharged engines.



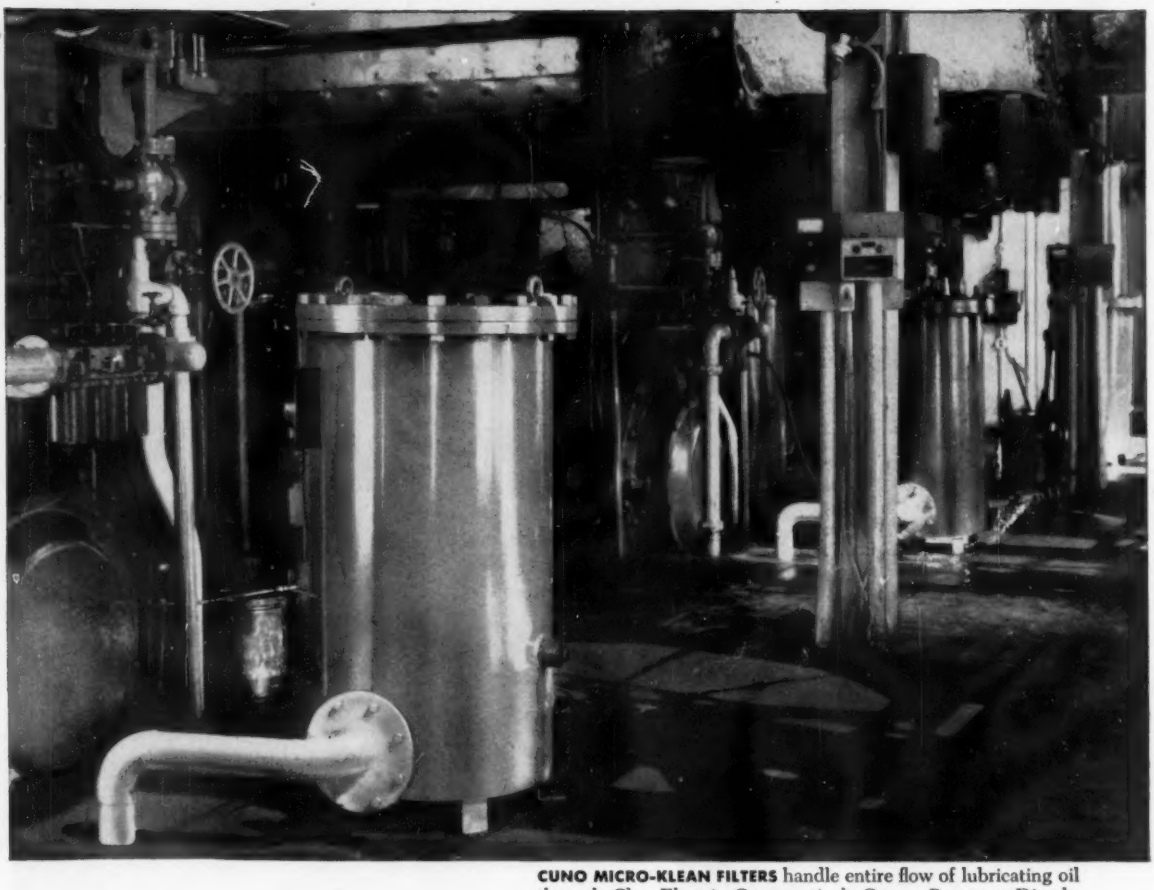
This 2120-hp engine in a diesel-generating power station gets a boost from the Elliott turbocharger.



EXPERIENCE MAKES THE DIFFERENCE...

It has been proved that turbocharging improves almost any diesel engine. It permits the engine to deliver more horsepower at lower fuel consumption. But be sure the turbocharger is an Elliott—the turbocharger backed by fifteen solid years of experience. Hundreds of thousands of hours of reliable operation in more than 12,000,000 hp of Elliott turbocharged engines on railway, marine, on-and-off highway trucks, stationary and heavy duty construction service stand behind today's product. It pays to specify Elliott turbocharging whenever you invest in diesel powered equipment. For complete details, write Elliott Company, Supercharger Department, Jeannette, Pa.

ELLIOTT Company



CUNO MICRO-KLEAN FILTERS handle entire flow of lubricating oil through Clay Electric Co-operative's Cooper-Bessemer Diesels.

How Florida electric utility knocked 25% off power production costs

We're talking about the Clay Electric Co-operative, Inc., in Keystone Heights, Florida.

In 1950, when they were burning distillate oil in their five Cooper-Bessemer Diesels, Clay's cost per kilowatt-hour was 9.914 mills. Switching to Bunker C oil in 1953 brought production costs down to 7.629 mills per kilowatt-hour. That's practically 25% in any man's language.

Our part in this success story? Cuno MICRO-KLEAN filters handle the tough job of filtering the entire flow (150 gpm) of lubricating oil through each Cooper-Bessemer. And according to Robert Dodd, Chief Engineer at Clay, the MICRO-KLEAN's are just right. Here's what he says: *"We're very pleased with the performance of the* MICRO-KLEANS. *They're very definitely assisting in making our success possible."* Mr. Dodd goes on: *"I heartily endorse your* MICRO-KLEAN *filters for lube oil service – they fully protect the engine from dirt particles. Trying to cut corners on filters can be false economy of the worst kind."* We agree, Mr. Dodd.

Want to know how MICRO-KLEAN can help solve *your* lube oil problem? Write us today for free MICRO-KLEAN bulletin. Cuno Engineering Corporation, Department 25, South Vine Street, Meriden, Connecticut. 4.11

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

Typical installation of American Hammered Conformable Oil Rings

AMERICAN HAMMERED CONFORMABLE OIL RING

Insures constant unit pressure for positive oil control!

You keep your oil consumption down when you install Koppers American Hammered Conformable Oil Rings! This service-tested piston ring conforms readily to meet cylinder distortion because its flexible cast iron member is pressed outward by an abutment type spring which exerts uniform radial pressure around the entire circumference.

Narrow bearing surfaces on either side of the channel give the ring a uniform unit pressure on the cylinder, enabling it to seat promptly and assuring maximum removal of excess oil throughout its lifetime. And the Conformable Oil Ring has a longer useful life because its low spring rate and uniform lands result in negligible changes in pressure as the ring wears.

Easily installed, it is ideal for both 2-cycle and 4-cycle Diesel & Gas engines; comes in 4" to 25" diameters with a minimum width of ¼". Write, wire or phone us today for full information on how the Conformable Oil Ring can improve *your* operation . . . or for expert help in *any* piston or sealing ring problem. KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1549 Hamburg Street, Baltimore 3, Maryland.

KOPPERS®

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland

This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers-Elex Electrostatic Precipitators and Gas Apparatus.

Engineered* Products Sold with *Service

AMERICAN HAMMERED *Industrial Piston Rings*

KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1544 Hamburg Street, Baltimore 3, Md.

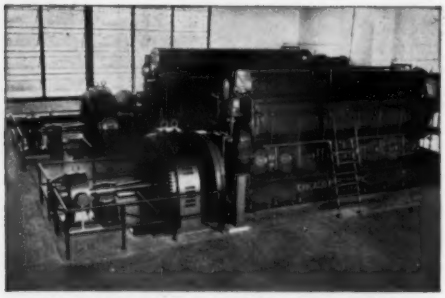
Gentlemen: Please send me full information on your Conformable Oil Ring.

Name .....

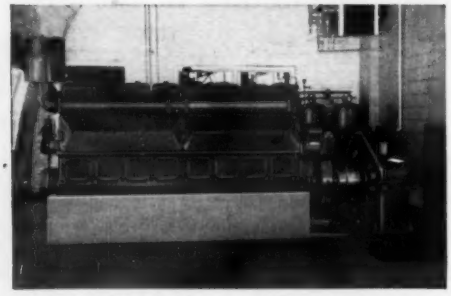
Company .....

Address .....

City ..... Zone ..... State .....

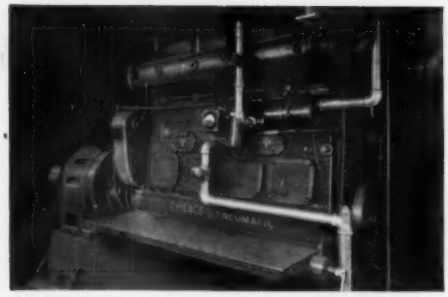


Two 1000 KW units in a Midwestern Public Utility.

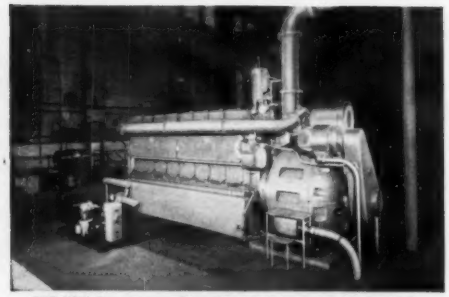


CP 400 HP Diesel in a petroleum pipeline station.

for INDUSTRY *or* MUNICIPALITY...



100 KW Sewage Gas engine in an Eastern municipality.



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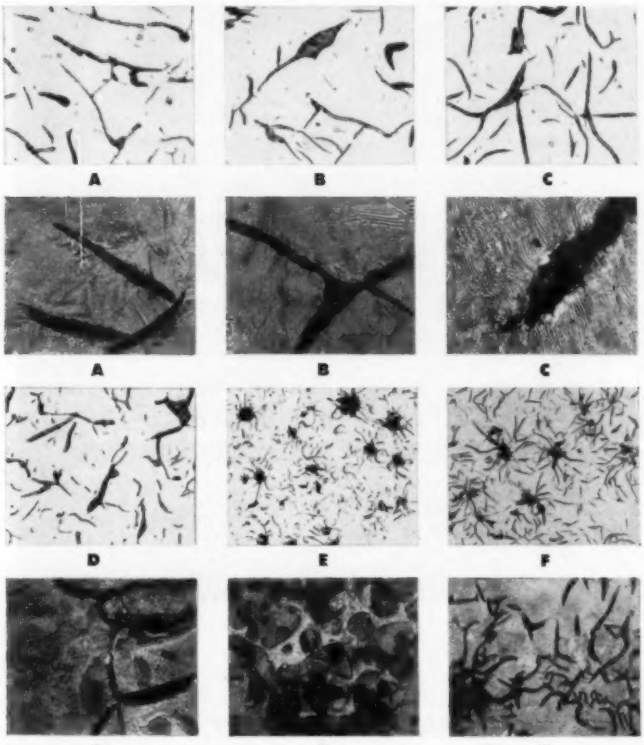

UPPER micro-photographs "A, B, C, D, E, F" show texture of some of DaRoS Metals—unetched—magnified 100 times. LOWER micro-photographs "A, B, C, D, E, F" are the *same* DaRoS Metals as shown above—etched—2% natal—magnified 500 times.

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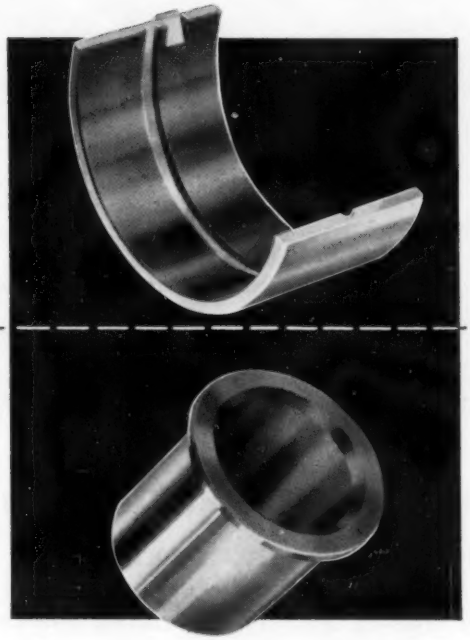
COPPER LEAD*

engine bearings



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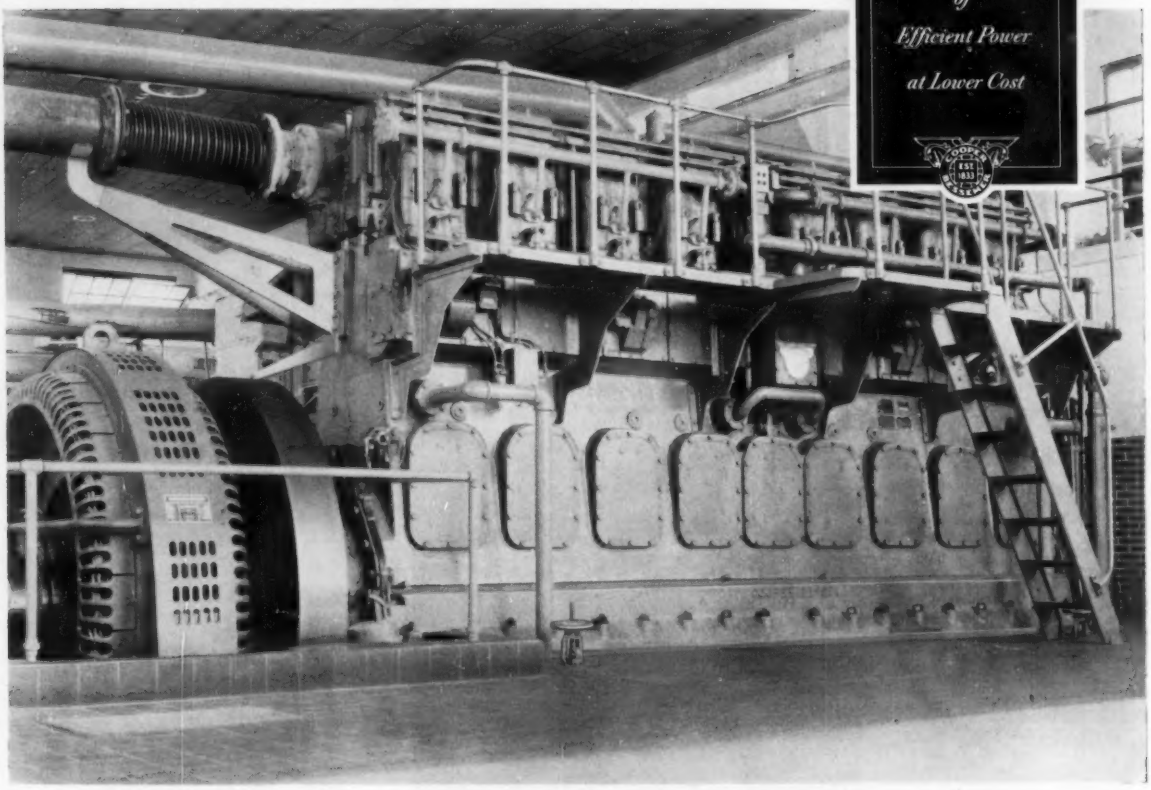
Another Example of Efficient Power at Lower Cost

• Here's the 8-cylinder Cooper-Bessemer LS engine, rated 900 hp at 300 rpm, in operation at the Robstown, Texas Light Plant.



Here's the COOPER-BESSEMER PERFORMANCE STORY at Robstown, Texas

- *Never Re-Rung During 36,000 Operating Hours*
- *12,000 Hp. Hours Per Gallon of Lube Oil*
- *In Operation 6,700 Hours on One Set of Spark Plugs*

• The performance of this husky, 8-cylinder Cooper-Bessemer LS engine at the Robstown, Texas Light Plant is mighty good, but really not unusual for Cooper-Bessemers. It's just additional proof of their efficient, lower cost operation.

Remember, Cooper-Bessemer Diesels, gas-diesels and gas-engines are built for all types of heavy-duty stationary or mobile service. Wherever you find Cooper-Bessemers, you can be sure of smooth, economical, trouble-free power.

Find out from the nearest Cooper-Bessemer office how you can meet power needs in the 200-5000 hp range, at the lowest possible cost.

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DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Standardization and Mobilization

Time is relative. You can kill it or sometimes buy it. In war, you generally buy it at the cost of lives. If nothing else, experience in two World Wars and in Korea taught us this. In World War I it took 14 months to get our first complete Division into action. In World War II it was eight months before Marines landed at Guadalcanal and 11 months before our landing in North Africa. If there is a next time, how long will we have? No one knows; that's a trump card in the aggressor's hand. But you can bet it won't be long. The aggressor's second trump is the ability to swap butter for guns and make the people like it. We can't. Our answer is a supportable level of military readiness plus plans for rapid military and industrial mobilization. The Department of Defense is currently rounding out these plans to work out industrial "battle stations". Our industry is vital to both the military and to our supporting civilian economy. This industrial mobilization involves production planning and such planning implies a substantial degree of standardization if it is to be sufficiently definitive for immediate implementation. Both as citizens and as businessmen we should contribute our "knowhow" in every possible way. To do this we must be told what the military has in mind. This is just what will be done at a Panel Session taking place on June 7th at the Annual Meeting of the Oil and Gas Power Division, ASME, Statler, Washington, D. C. Top men in the planning agencies will discuss the concepts of their programs. Top executives from our industry should be there to get these ideas at first hand. Understanding and agreement must be attained at the "concept" level first, and these executives are used to dealing in concepts. After this, production planning can go forward on a much sounder basis. We sincerely hope that our industry's top executives will attend and contribute to this discussion of vital phases in industrial mobilization.

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highlights

- The American Society of Mechanical Engineers will hold its spring meeting at the Lord Baltimore Hotel, Baltimore, Maryland, from April 18 to 20, 1955.

- General Motors' president, Harlow Curtice, recently confirmed that GM's Electro-Motive Division is currently developing a lightweight passenger train. This is in line with current thinking and research in the railroad industry.

- Steam power has gone by the boards on The Milwaukee Road. All power for the road is now furnished by either diesel or electric locomotives.

- The Electric Auto-Lite Co. is now conducting classes in its newly expanded service school in Toledo. The 3-week course is open to anyone in the automotive service field. Information may be obtained by writing the Education Dept. of the company at Toledo 1, Ohio.

- Truckers and railroads have recently taken the initial step to erase issues between the two industries and insure a strong common carrier system. A meeting of officials from both industries was held early this year in New York City at which time the Council of Rail and Truck Common Carriers was formed.

- According to AAR, Class I railroads installed 121 new diesel-electric locomotive units during January of 1955. The corresponding figure for 1954 was 159. As of February 1, 1955, Class I railroads had 462 diesel-electric units on order as against 486 for the same date in 1954.

- Pacific Fruit Express has received the first deliveries of another 200 mechanically operated refrigerator cars. The refrigration unit in each car is powered by a diesel.
GM has announced a plan to provide 100 college scholarships each year as one phase of its new program of financial aid to higher education.

- Since 1937, the Detroit Diesel Engine Division of General Motors has produced diesel engines for earthmoving equipment, oil well drilling rigs, fishing boats, etc., equal to over 61 million horsepower.

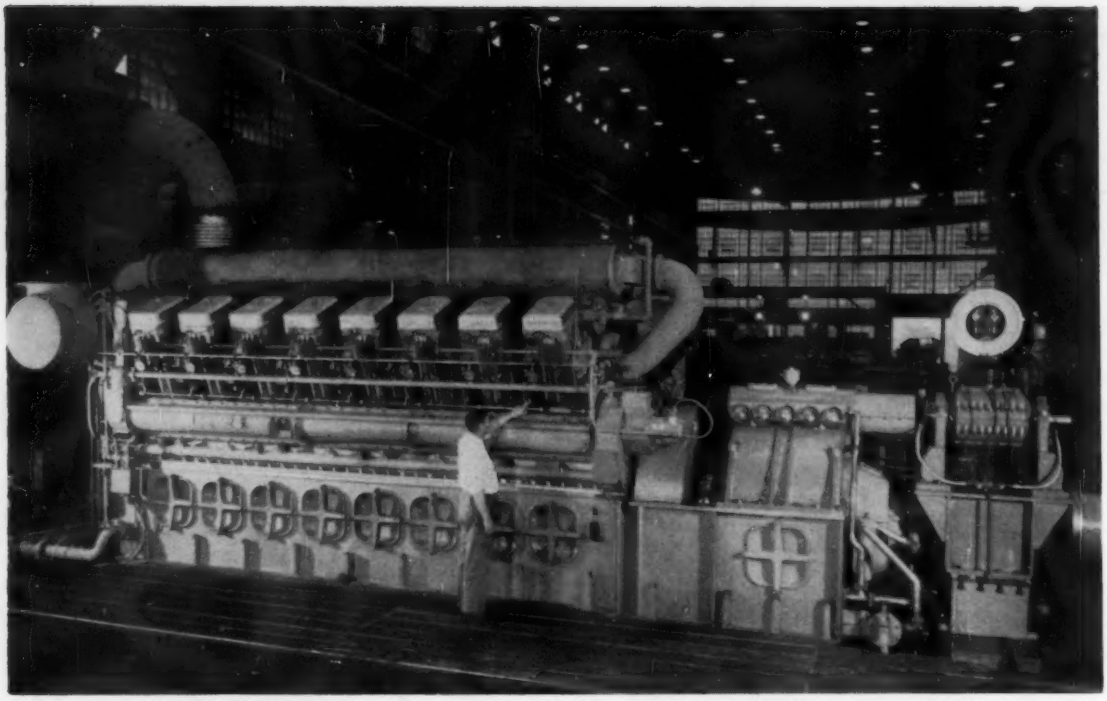
- B-L-H recently received an order from Natchitoches, Louisiana for two Model 821-SA engines, equipped for dual-fuel operation. The addition of these engines will increase the city's municipal generating capacity by about 5500 kw.

- Manufacture of GE's 100th gas turbine was recently announced by Mr. John P. Keller, general manager of the company's gas turbine department. Of the 100 units, 97 are now installed in widely separated parts of the country driving locomotives, generating electricity, pumping gas through interstate pipelines, and in an oil refinery.

- During 1953, internal combustion engines produced more than 3,899,000,000 kwh of electrical energy throughout the United States. The increase over 1952 was about 1½ million kwh. Percentage of total kwh production for internal combustion engines was 0.88% as compared to 23.77% for hydro and 75.35% for steam.

- Annual report of the American Petroleum Institute and the American Gas Association said, ". . . liquid petroleum reserves rose to 34.8 billion bbl in 1954, while those of natural gas climbed to 211.7 trillion cu ft. Net increases for liquid petroleum and natural gas are 422 million bbl and 263 billion cu ft, respectively."

- Westinghouse and the Army Corps of Engineers have developed an electric governor for more accurate control of engine-driven generators. The device operates by sensing extremely slight variations in generator's output frequency and making necessary corrections in the power source driving the generator. A small signal-sensing instrument, a magnetic amplifier similar in appearance to a small transformer, is the heart of the governor.



The Nordberg Supairthermal V-16 on test. Compactness of the engine is pointed out by size of man in picture.

Supairthermal Vee for Gas Pipe Lines

Nordberg's Supairthermal engine line now includes a powerful, compact, and efficient gas engine tailored for pipeline needs.

LATEST of Nordberg's Supairthermal engine executions is a 12- and 16-cyl vee-type unit built specifically for gas pipeline service. Of course, the Supairthermal features and general engine design is equally adaptable to other services, but in this version pipeline requirements were kept uppermost in mind. As one example, the welded engine base was extended to incorporate a Nordberg-designed step-up gear for driving a centrifugal compressor.

Spark-fired natural gas is the fuel used, although other engines of the Supairthermal line have burned propane, manufactured gas, and sewage gas. This emphasizes the point that while the pipeline engine is to be discussed, the bulk of the features described have equal application in other fields.

The 12-cyl engine is rated 2650 hp and the 16-cyl, 3550 hp at 500 rpm. Bore and stroke are 13 and 16½-in respectively. The expansion ratio on these engines is 12½ to 1, while the compression ratio will vary in accordance with the setting of the Supairthermal mechanism so as to maintain a practically constant air/fuel ratio throughout the operating range. The result as it affects fuel economy is to give a relatively flat specific fuel consumption curve and particularly so from one-half to full load. Brake thermal efficiencies of over 40% are obtained.

Building Up the Engine

Start with the bedplate. Perhaps "base" would be a better word since this structure does not follow earlier practices of "bedding" the crankshaft. It is a rigid weldment of deep section with substantial lateral bracing. Its extension to support the step-up gear provides for getting and holding good engine-to-gear alignment. Generous access doors in the base make it possible to get at the main and connecting rod bearings without further dismantling.

The frame is also a weldment and a good, compact, rigid one too. The crankshaft is "hung" in massive transverse main bearing supports and rigid steel caps, each held by two steel through-bolts. Combustion forces are transmitted right to the top deck through the bearing

support structure and heavy sections between the top and bottom members of the cylinder compartments.

Each cylinder is an assembly consisting of an outer cast iron cylinder and an inner liner of special heat-treated alloy cast iron. The water jacket lies between these two components, leaving the engine frame completely dry. This eliminates corrosion problems in the frame. It also minimizes the possibility of water leaks to the base since cylinder assemblies are installed and removed from the engine as units and without disturbance of the seals.

This also facilitates maintenance. By removing the connecting rod bearing cap and the nuts from the four cylinder retaining studs, the cylinder assembly plus the piston and connecting rod assembly can be removed as a unit.

Cylinder heads are held to the cylinder assembly also by four studs and nuts. Here is one of the few changes made in the basic engine as used for diesel or dual-fuel operation. Ordinarily, cast iron heads are used, but for the gas version they are cast of aluminum alloy. The design is essentially the same after some allowance is made for the difference in materials. For example, the aluminum head uses valve inserts while the cast iron head seats the valves on the head material. There are no water passages to complicate head-to-cylinder sealing as external jumper lines are used. Flow is directed for greater cooling efficiency.

As to major rotating and reciprocating parts, let's start with the crankshaft. It is a relatively short stiff forging, drilled for full pressure lubrication, fitted with counterweights, and finely finished. Proportioning of the journals and pins is sufficient to provide low bearing pressures. All bearings are of the precision type.

Side-by-side arrangement is used for the connecting rods. These are high-carbon steel die forgings, rifle-drilled for piston pin lubrication and spray oil cooling of the pistons. The piston pins are full-floating, hollow-bored, hardened, ground, and polished.

The iron alloy used in the pistons was selected for its heat and wear resisting qualities. The surface is treated with one of the processes that improve lube oil dispersion and aid in proper break-in. Six rings, four compression and two oil control types, are used and are all located above the piston pin.

Each cylinder bank has its own camshaft, gear-driven from the flywheel end of the engine. Valve cams are shrunk in place while the fuel cams are adjustable. The variable inlet valve timing mechanism, under control of the actuators, parallels the camshafts. More on this later.

Under the heading of vital accessory items is the air starting system (250 psi, max.) which is of the pilot type with a pilot air distributor located at the end of one of the camshafts.

The lube oil pumps for full pressure lubrication are driven from the crankshaft by a multiple-strand roller chain. Circulating water pumps are gear-driven through a spring coupling.

Gas Fuel System

Nordberg gets the gas into the cylinder through a separate gas valve in the head. Gas is supplied through a header to each of these valves at a pressure of 20 psi. Metering is hydraulically controlled. One advantage of the at-the-head control is that response to load changes is as fast as for oil injection. There is no column of gas between the point of control and the cylinder to be worked off before governing changes are effective.

There is probably no commercial device that gives closer control of oil volume delivery than the fuel injection pump. So Nordberg used a standard Bosch-type pump with the delivery valve removed to supply the actuating oil to the gas valve. A hydraulic governor, driven from the flywheel end, senses engine speed changes with load and appropriately alters the actuator's rack settings through a simple linkage.

The Bosch-type actuators are timed and reciprocated by the fuel cam on the camshaft. Thus all the functions necessary for close metering of gas to the cylinders are precisely controlled.

Originally, manual valves were installed in the headers' branch lines for balancing. These were found unnecessary, except perhaps as shutoffs, because once the actuator racks were set by the linkage to balance out the cylinders, the system's design maintained the balance throughout the load range.

Ignition System

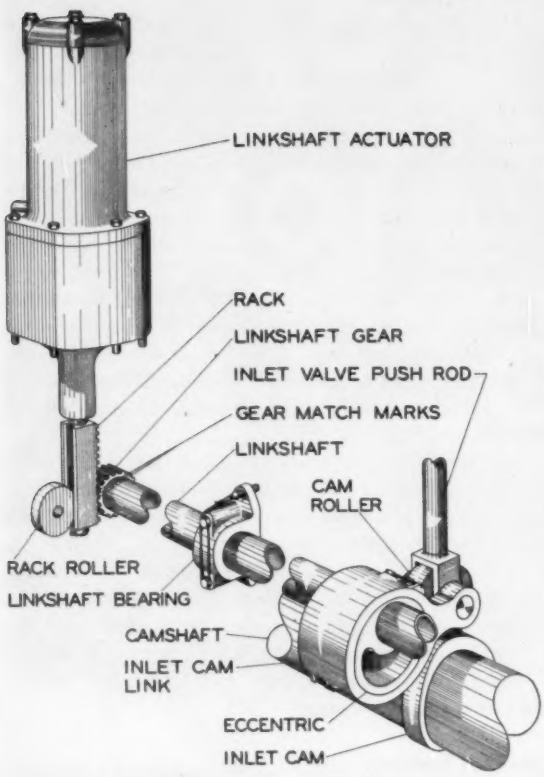
American Bosch pulse generators similar to those used on the many aluminum-plant Nordberg "radials" were used for this engine. Low-tension impulses are rectified and carried by wires to rectifiers and high-tension transformers located right at the cylinder heads to keep high-voltage lines to a minimum. Double secondary windings supply impulses to the dual spark plugs. Resistors are used right at the plugs.

Arrangement is made in the heads for water-cooling the spark plugs. This, the resistors, and the high cooling effect of the Supairthermal system, are believed to be factors in the exceptional plug life that Nordberg reports.

Supercharging System

The supercharging system operates entirely on the Supairthermal principle. Its purpose is to increase load-carrying ability and improve efficiency without the extreme pressures, temperatures, and peak bearing loads that ordinarily accompany such ratings. There are three major items involved: a high-pressure turbocharger; an intercooler; and variable inlet timing.

DeLaval's high-pressure turbocharger was used in this case. The pressure ratio at full-load is about 2.8 to 1. The compressed supercharging air enters the intercooler that runs the length of the engine. Cooler design and the quoted ratings are based on 90°F water for cooling. Under this condition, the temperature differential is reduced to 10°F; or in other words, 100°F air is made available at the intake valves.



LEAD CONTROL MECHANISM

Now we come to the variable intake valve timing feature. Its purpose is to regulate the point of intake valve closing so as to control the amount of air entering the cylinder in accordance with the load. Less air is allowed to enter the cylinder as the load gets lighter and vice versa. This maintains a relatively constant air/fuel ratio throughout the load range.

The mechanical method of doing this is illustrated. Spring tension within the actuator is initially adjusted to give the desired air/fuel ratio, after which it is automatically maintained through a good portion of the load range. Since turbocharger pressure is a function of engine load, this has been arranged to be the controlling medium.

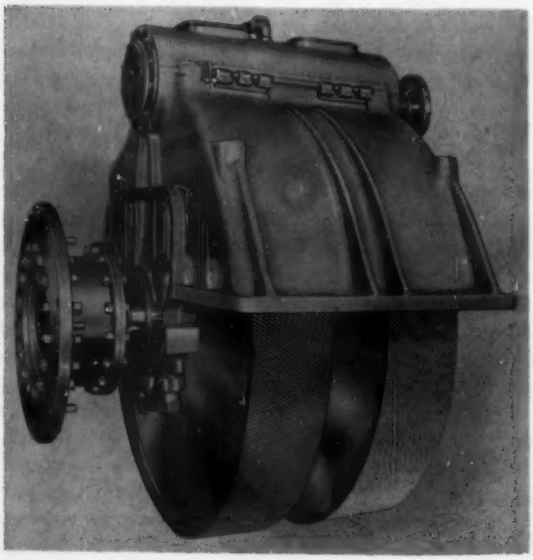
Admittedly this could also be done in other ways such as throttling the intake air at partial loads. However, this is only one of the features of the Supairthermal system. Scavenging, for example, is more effective because the pressure differential between intake and exhaust is always maintained. This is also a factor in cooling hot cylinder parts during blow-through.

Most important, however, is the ability to alter the net effective compression ratio while maintaining a constant 12½ to 1 expansion ratio. This is done automatically as the intake valve cutoff point is being altered in accordance with load. The valve closes before the piston reaches bottom dead center and consequently the air is expanded during the remainder of the stroke. Therefore, at the start of the compression stroke, the air pressure in the cylinder will be below that of the intake manifold. The result is a low net compression ratio.

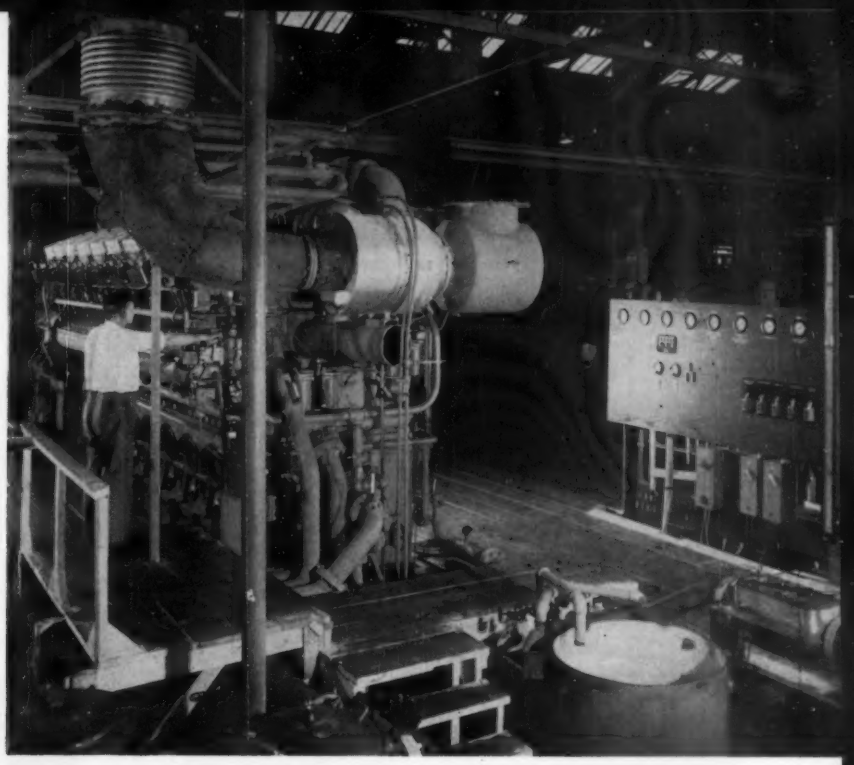
All that is compressed in the cylinder is a controlled amount of air sufficient to support the complete combustion of the fuel needed to meet the load. The reduced net compression results in lower temperatures at the start of combustion. This is particularly important in gas engines because compression temperatures below the detonation limit make it possible to operate with minimum excess air, as required for high combustion efficiency.

To put the whole thing very simply, the Supairthermal system could be considered as two stages of compression. The first stage occurs in the high-pressure turbocharger. This compression is obtained at the expense of a normally waste product—energy rejected in the exhaust gases. The bulk of this pressure is retained, but the temperature level is greatly reduced in the intercooler.

Two things are done with the product of the first compression stage. First, the full air pressure at the low temperature is available for scavenging and internal cooling. Then by means of a selective device, enough of the compressed air is used to provide the right amount of air for the required amount of fuel at a net compression ratio selected on the basis of load. The low temperature of the air plus the lower net effective compression ratio permit high average pressures to be obtained without a correspondingly high mean cycle temperature. This is attained completely independently of the high constant expansion ratio of 12½ to 1.

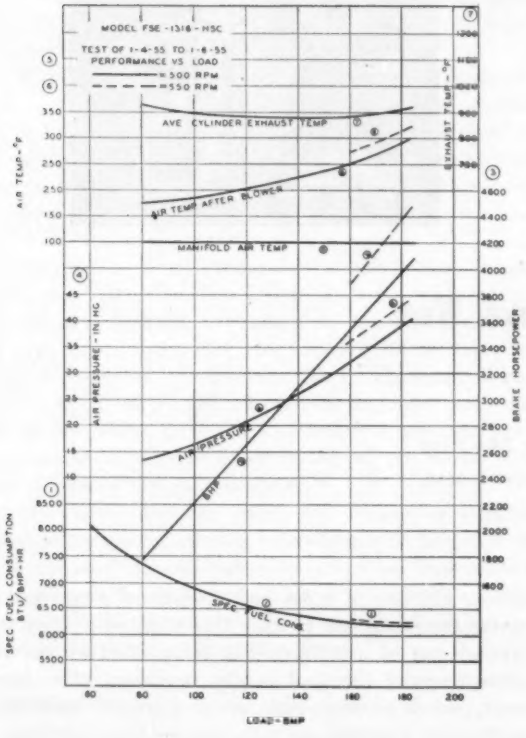


View of "step-up" gear removed from engine. Lower half of housing is part of the engine bedplate. Alignment between engine and step-up gear pose no problem since they are an integral unit.



Turbocharger end showing control and instrumentation set-up for testing. Oil filters are shown in foreground. Panel at right is equipped with temperature and pressure gauges, alarms and annunciator.

Performance chart (below).



Step-Up Gear

Popularity of centrifugal compressors for applications where large quantities of gas must be compressed at low compression ratios was the impetus for incorporating the step-up gear with this engine design. It is a good arrangement because the engine and gear are matched units in a compact design and certainly an alignment problem is eliminated.

The bull gear is driven from the engine by a quill shaft arrangement. The helically-cut teeth are of the split-herringbone type and eliminate lateral thrust. The bull gear is of welded construction and the teeth are hardened, cut, crowned, and shaved.

The pinion is made from a 1-piece forging and the gear unit is designed to be built in ratios from 6:1 to 10:1. The same casing accommodates all the ratios. A 3-bearing support is used for the pinion with one located in the center. Full pressure lubrication is used for all bearings.

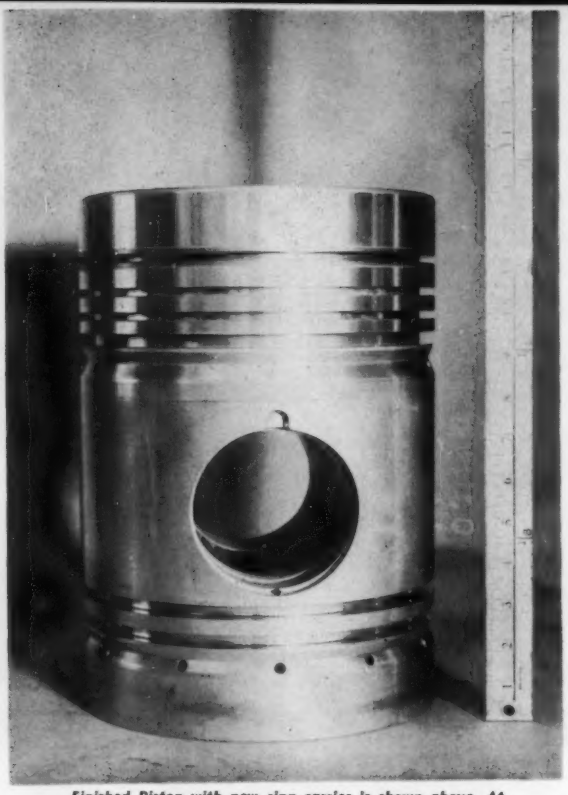
One feature of these gears is their hardness. The pinion tooth face hardness is 390 Brinell and the bull gear ring, 300 Brinell, both higher than with most similar gears. The high tooth hardness plus the differential between the two will contribute to greater life.

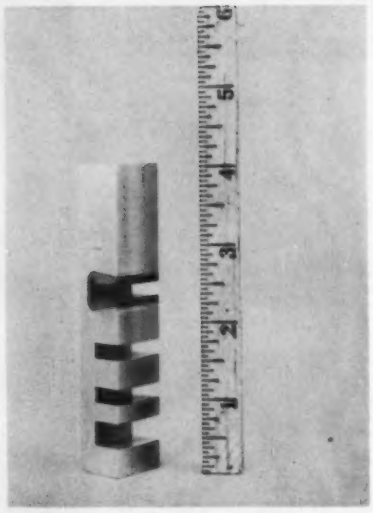
Results and Observations

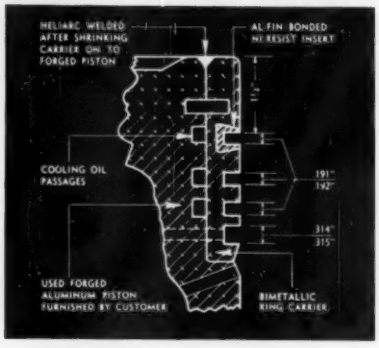
The engine's reactions to the various design features are told on the accompanying performance chart. That's the only opinion that really counts.

During observed test runs the engine started right up, picked up the load quickly, and was very responsive to load fluctuations. A check on pyrometer readings as indicative of cylinder balancing showed excellent stability at various loads. The noise level of both the engine and the gear appeared to be quite low; in fact, the engine didn't seem to be working very hard even at full load. There was no semblance of detonation at any point in the load range right up to overload bmep's.

This engine has been sold to the Transcontinental Gas Pipeline Corporation for installation in a gas pipeline station located near Houston, Texas.






HELIARC WELDED AFTER SHRINKING CARRIER ON TO FORGED PISTON
AL-FIN BONDED NI-RESIST INSERT
COOLING OIL PASSAGES
.191" .192"
.314" .315"
USED FORGED ALUMINUM PISTON FURNISHED BY CUSTOMER
BIMETALLIC RING CARRIER

Finished Piston with new ring carrier is shown above. At upper right, section through ring carrier showing insert. At right, sectional view of ring carrier on piston.

Bi-Metallic Ring Carrier Cuts Groove Wear

Ohio Piston Company's cast aluminum ring carrier for 244 Alco engines protects top ring groove with bonded Ni-Resist insert.

PARADOXICALLY, benefits in engine performance obtained through the use of aluminum pistons are often contributors to the piston's downfall. Modern engines are taking more and more advantage of the lightness and excellent heat conductivity of aluminum to produce higher cylinder outputs. One result is increased loading between piston rings and piston lands. This is a major reason for ring groove wear, the principal cause of aluminum piston failure.

Today, bi-metallic pistons are solving this problem. By using a harder and more wear-resistant material for at least the top ring groove, service life has been increased several times over that of the all-aluminum piston. Millions of miles and operational hours under severe conditions are proving this continually. Any increased cost of manufacture is being offset by the increased service life, and besides deferment of replacement, periods between piston servicing are increased. This spells lower maintenance costs and reduced downtime.

Bi-metallic pistons are gaining increased acceptance every day in all heavy duty services. They are built in sizes from about 4-in to 14-in diameters for everything from automotive-type engines to heavy industrial-type units. Yet this successful solution to so troublesome a problem seems so simple as to raise the question, "Why didn't they do it before?"

Perhaps the answer can best be given by a specific case. It is only natural that the benefits being obtained in other fields would be extended to the railroad field as well. This particular example is a new cast aluminum ring carrier with a Ni-Resist top ring groove insert. It is designed for replacement use on 244 Alco oil-cooled pistons.

Development

The apparently simple problem of using two metals for a piston is really a tough one, particularly when one metal is ferrous and the other nonferrous. How do you join them together? Mechanical bonds had little or no success; a molecular bond was necessary. Al-Fin Division, Fairchild Engine and Airplane Corporation, found the answer to this in their work on such problems as bonding aluminum cooling muffs to aircraft cylinder liners. Their patented process solved the bonding problem.

Now, what metal do you bond to the aluminum? Here, the International Nickel Company contributed something. Their proprietary "Ni-Resist", a high-nickel cast iron, had ideal qualities for the job. It was wear-resistant, good with respect to scuffing and galling, excellent in resistance to high-temperature corrosion, and had thermal expansion properties very similar to those of some aluminum alloys commonly used for pistons.

With the bonding process and the materials available, the next step was design and development. Al-Fin worked with American Locomotive Company in 1949 to develop a bi-metallic ring carrier. Research work was carried on in the Development Laboratories of the Aluminum Company of America. Collaborating in this research was the Ohio Piston Company.

The pooling of this technology enabled Ohio Piston, with their specialized knowledge of piston manufacture dating back to 1913, to produce the final product. It is a cast aluminum band or ring carrier with the top ring groove protected by a Ni-Resist insert. The shape of the insert has been worked out so that any stresses at the bond line, either tensile or in sheer, that are caused by the minor differences in expansion of the metals will be well below the bond strength.

This means that the insert will remain an integral part of the piston, offering no resistance to heat flow at the interface. Dimensionally, the carrier has been worked out to provide the proper shrink fit on the piston, and once welded in place there is no chance of oil leakage from the piston's cooling oil grooves.

Installation

In addition to working out the details of design, installation methods had to be worked out as well. Rebanding of these 244 Alco pistons is not new to many of the railroads and those having the necessary equipment and experience will have little trouble in installing these carriers. For others, Ohio Piston has set up a service to reband the pistons at the plant.

When ring groove wear exceeds tolerable limits, it has been general practice to machine off the old carrier and replace it. In general, the practice is the same with these new cast carriers, but a few precautions are necessary due to the difference in material (plain carriers are aluminum forgings).

Machine the piston shoulder OD to 7.655-7.656-in. This will give a 0.006 to 0.008-in interference fit. The carriers come with a ⅛-in by 30-deg bevel at their upper inner edge and a 3/16-in radius at the inner lower one. When the piston shoulder is being machined to the proper diameter, a 5/32-in radius fillet should be left at the bottom and the ⅛-in by 30-deg bevel turned at the top. The difference in radii at the bottom leaves a little room to insure that the bottom and back of the carrier will seat properly.

Carriers come completely machined, with one exception. After the shrink fitting, ten ¼-in oil drainage holes are spotted and drilled through the back of the fourth ring groove.

The two upper bevels leave room for penetration of the weld. Heliarc welding is used to join the piston and carrier. During welding, use lower densities than those previously used with the forged carriers. The best possible practices should be used to insure a proper weld. A final machining operation cleans up the piston head.

Results

With all of the preliminary research, there was little doubt that results would be comparable to those being obtained with other bi-metallic pistons. The first installation was made in an engine of the Alton and Southern Railroad. They were subjected to severe tests, including continuous 24-hr tests over extended periods. When examined, they were found in excellent condition and are still in operation.

Perhaps acceptance is a good measure of the results. As mentioned, rebanding is being done at the Ohio Piston's Cleveland, Ohio plant, although ring carriers are also being sold directly to those railroads having the facilities and experience for installation. The volume of rebanding work at the plant has now grown to permit grouping for production-type operations. The resulting savings have been passed on to the users of the service in the form of a lower unit price.

	Aluminum Piston Forging	Aluminum Carrier Casting	Ni-Resist Carrier Insert
Alloy Designation	Alcoa 32ST6	Alcoa A132T551	Ni-Resist #1A
Alloy Analysis:			
Copper	0.9	0.8	5.50- 7.50
Silicon	12.2	12.0	1.50- 2.75
Magnesium	1.1	1.2	
Nickel	0.9	2.5	13.50-17.50
Manganese			1.00- 1.50
Chromium			1.75- 2.50
Total Carbon			2.8 Max.
Coefficient of Thermal Expansion:			
Av. for Range of 70°F to 400°F	11.3×10^{-6}	11.3×10^{-6}	10.7×10^{-6}

Overall view of the shop from the parts department end. Vehicles are accommodated in 10 stalls. Engine and chassis dynamometers are at far end as is cleaning stall.

Talking Shops

From time to time Diesel Power will visit various shops for an interview with the Service Manager. We think that many of our readers will be interested in how the other fellow does things, his ideas and his tooling—Ed.

NEWARK, New Jersey Cummins Diesel Sales Corporation shop was selected to get this program rolling. Since we will concern ourselves with the maintenance end of the operation, the man we want is the service manager —he is Tom Perera.

After the preliminary go-round, we took a walk through the shop. The first thing noticed is the cleanliness, and the next, the production-line type arrangement of this departmentalized shop. Along the right side of the building, as one walks back, are 10 stalls for trucks, tractors, or buses. The remainder of the shop is divided into departments such as fabrication, injector, fuel pump, machine shop, cylinder head, engine rebuilding, engine test, chassis dynamometer, cleaning, and a fully stocked parts section.

By the time we walked through the shop, several questions had formed and more were on the way. Now, we wanted some answers.

Q. Tom, were you in on planning the layout of this shop, or was it something planned for you?

A. I was in on the planning all right, and so were my foremen. We started long before the move took place by studying other shop layouts and making up dozens of drawings of different arrangements. Then each week, at the foremen's meeting, we would take ideas from everyone including the men in the shop, tear the layouts apart, and have more drawn up. Finally, we arrived at this layout.

Q. What were some of the more important considerations in planning the arrangement of departments?

A. Saving steps was a prime consideration. Volume was another. Then we had to consider the work flow parts handling in the shop. It had to be arranged to permit re-

built parts to converge at the rebuilding station without delay to this stage.

Q. Have you any pointers for someone faced with the job of laying out a shop of this type?

A. We were pretty sure just about everything had been thought of when our final plan was drawn, but after working in the shop for a while, we discovered that a few items were not thought of. We don't have enough walls. It would be much better if the engine and chassis dynamometers were in a separate building. This would lower the noise level considerably.

Also, the injection equipment repair section should have its own enclosure, as should the machine shop. With the building we have now, this cannot be done effectively. Shop planning is a subject in itself and requires a lot of thought. Another item not incorporated in this shop, but one which I consider a must, is a through-lane for tune-up work only. This would eliminate tieing up several stalls as all trucks for tune-up could be run right through the building and out the other side.

Q. Can you give us some idea of your daily work load?

A. Sure, but it's hard to be specific. Each day we start 25

Looking from the other end, the rebuilding section is in the foreground, machine shop at left. Refinished parts are placed in baskets and bins on rolling racks.

to 30 jobs. These can be anything from complete engine rebuild to injector overhaul or tune-up. We have the capacity to handle 1½ complete engine rebuilds in the normal working day. In other words, when all departments are going strong, 1½ engines will drop off the line in the engine rebuilding and test departments each day.

Q. Where does most of the work come from?

A. Talk about generalized questions, that one is a pip. We get it from all sides, stationary, marine, railroad, transportation, materials handling, and so on. As for area, we stay on the west of the Hudson except for Manhattan. Staten Island is our too. We go south to about Trenton, New Jersey and north to Newburgh, New York. Now don't ask me how the work breaks down as to specific job or we'll be here for the next two days. Tune-up, however, makes up the best portion of it.

Q. What about personnel, Tom? How many men does it take to handle this work?

A. I have 19. This includes three working foremen.

Q. Are any of these men specialists?

A. They are all specialists in one sense of the word; they are specialists on Cummins engines. But if you mean, do they specialize in one particular phase of the operation, the answer is no. I make a practice of swapping men around to different jobs. Any one of them can be put into the injection repair section or in any other department for that matter. In other words, each man is trained to do any job.

Q. What training do the men receive?

A. The foremen receive factory training. In this case, it means one week at the factory in Columbus, Indiana twice a year. The mechanics are trained here.

Q. Now suppose we get into the actual operation in the shop. Say I bring my engine in for an overhaul; what happens?

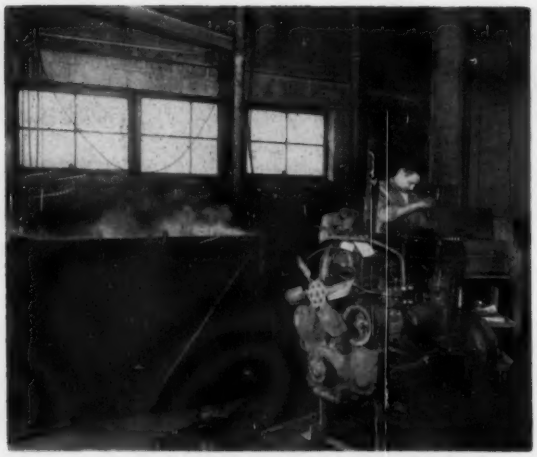
A. First, the engine goes to the cleaning room where it is taken down and the parts tagged and cleaned. This goes for the engine block right on down the line. Naturally, inspection is the next step after cleaning. As you would expect, we follow the Cummins Shop Manual to the letter. Each mechanic has his own manual with his tools for ready reference. The manuals are law here. Parts go to their respective departments for inspection and servicing. I should also point out that once an engine is torn down and placed in the line, parts stay in sequence until the engine comes out the other end—completed. This is necessary since otherwise all departments will be thrown out of sequence, as they work more or less in parallel, with reworked parts arriving at the rebuilding station simultaneously.

Q. What happens in the cylinder head department?

A. A water test under 35- to 85-psi pressure is the first step after valve gear is removed. Water circulation is also checked. Valve seats are next. If seats are more than 0.125-in wide, they must be narrowed with a 60-deg stone or replaced. Loose seats must also be replaced. Then we check the seating of the injector in the sleeve. Scratched or distorted seats or poor sealing call for sleeve replacement. Injector protrusion should be 0.040 to 0.055-in. Reseated sleeves, however, can be used until protrusion reaches 0.065-in.

Valves and guides are next. Valves are discarded if too thin to regrind or if heads are cupped, pitted, or cracked. Guides are checked and replaced if necessary. Valve springs are checked for tension and length. Also, the cylinder head is checked for height. Spacers are used to compensate for the deeper seating of valves when seats are reground.

To check the valves after the head is rebuilt, a vacuum



Engine teardown is done in the cleaning room. Parts are tagged, placed in baskets, cleaned, and inspected for repair or replacement.

Crankshafts are stamped with the work order number before removed. Magnaflux inspection, cleaning, and inspection for wear follow.

In cylinder head department, mechanic uses shop-fabricated rig for counterboring head for valve seat inserts. Machine shop is in background. The lathe in the picture is equipped with a lathe converter.

tester is used. Fall-back of the hand on the vacuum gauge indicates if sealing is satisfactory. We feel that its equally important to carefully inspect heads prior to and after rebuilding. This goes for other assemblies too, including the rebuilt engine.

Q. How about the machine shop? It looks like this department gets the large portion of the work.

A. To give you a brief idea, crankshafts and connecting rods are magnafluxed here as well as receiving other pertinent checks. Connecting rods, for example, are checked for bore alignment and elongation. Valve and injector rocker arms are also rebuilt here, as are the cam followers.

Q. Now suppose we look at the fuel pump and injector shop. What happens here?

A. Anything from cleaning and adjustment to complete overhaul with replacement of worn parts on all models of Cummins injectors and pumps. Upon completion, all pumps and injectors are thoroughly tested.

Q. This brings us to the engine rebuilding section. How about a short run down on this phase?

A. One thing I neglected to point out before is that when an engine is ready for tear-down, a mechanic is assigned and generally he follows through on the overhaul until it is complete and delivered to the test cell. Engine parts arrive at the rebuilding station and are placed in a rolling rack, designed to hold all of the component parts. Each rack has several trays and baskets to hold certain parts. The oil pan, crankshaft, camshaft, piston-connecting rod assemblies, and other parts, all have their own spot on the rack.

Main bearing alignment and cylinder liner counterbore depth are checked here. A careful check of tolerances and fits is also made as the engine goes together. The sequence and tolerances are those specified in the engine manual. From this point the engine goes into the engine test cell and is run in on a dynamometer.

Q. We are in the test cell, now what do we look for?

A. Again we have an SOP from the manufacturer. After being placed on the dynamometer and all hooked up, the engine is started and brought up to 800 rpm at no-load. Oil pressure and water circulation are checked immediately and if OK, the engine remains at this speed with no load for 5 to 10 min.

The next step is 1200 rpm at 25% rated load at this speed for an hour, at the end of which time valves and injectors are readjusted. Following this, the next hour of operation is at 50% of the rated load at 1600 rpm. Cylinder head stud nuts are re-torqued and engine rpm then increased to 1800 and load increased to 75% of the rated load for 1800 rpm. This final run lasts for three hours.

During the run-in, a careful check is made, especially on blowby gases to see that rings are seating. Three power checks are made during the 3-hr run. When the engine passes this final check, it is given a coat of paint and is ready to be placed in service.

Q. We notice that the entire shop is kept clean and neat. What's your secret?

A. It's no secret. The men make a point of keeping the shop clean. When oil is spilled, a dry chemical is used. When a part is to be replaced, the old one is turned in to the parts department. This keeps the parts from piling up in corners or on benches.

Q. How about electrical equipment, Tom? We haven't seen anything on this part of the operation.

A. I figure the electrical equipment manufacturer or his representative is better equipped to handle this end of the maintenance work—so we farm it out to the fellow who has the best know-how and the right tools. It also saves us another department and personnel. The same goes for air compressors. We carry spares to keep engines on the line or can get replacements in a hurry.

Q. Have you developed any special techniques or tooling to ease your work here?

A. Definitely. What shop hasn't done its own thinking on this subject? We have developed a number of special tools to do jobs more efficiently; but now they are no longer exclusive to this shop since we have sent them to the manufacturer and many of them now appear as Cummins service tools. We modified a COE recently so we could re-engine a rig per day by pulling the radiator and reaching in and pulling the engine out from the front.

At first, we had to remove the radiator, then the mounting bracket and a basket of other parts to get at the engine. Now, the trucks are manufactured so as to incorporate our modifications—a few bolts are taken out and radiator and mounting bracket are out of your way. We have a bus on the floor now, which we are modifying to take a Cummins diesel in place of a gasoline engine. This called for a new engine mounting cradle which we made up in our fabrication department. When it is finished, the engine will be easy to change.

A feature of this modification job is a connector block which mounts a number of lines leading from the engine. This keeps all connections such as fuel lines, air lines, and so forth, in one spot, making short work of engine replacement. Swivel couplings are used on the chassis side of the connection.

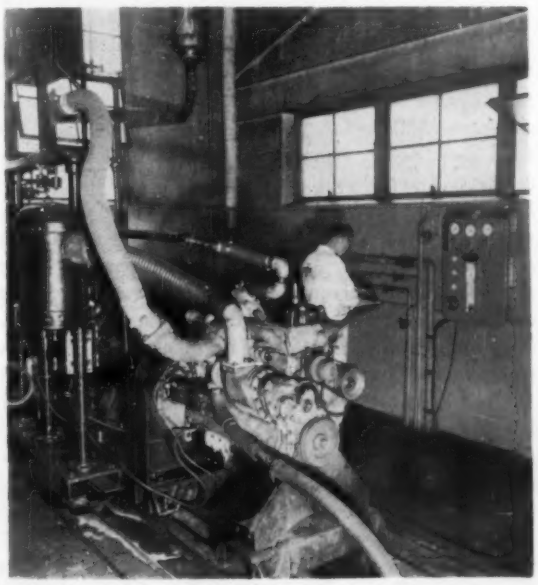
Q. To wind this up, how about the operator or owner?—have you any pointers for these fellows which would better their operation and perhaps reduce their maintenance bills?

A. The air cleaner and its connections seem to be the main consideration. We have engines come in and we find them in the field with loose air cleaner connections or poorly maintained cleaners and the owners wonder why they don't get the hours out of the engine.

I also tell most of the truckers to take a penny for each mile traveled each day and hide it somewhere, even if they have to bury a milk can in the back yard. Then, when it comes time for an overhaul, it will be painless to the pocketbook. Figure it out. Even this doesn't help, though, if you don't give your engine the care it needs.

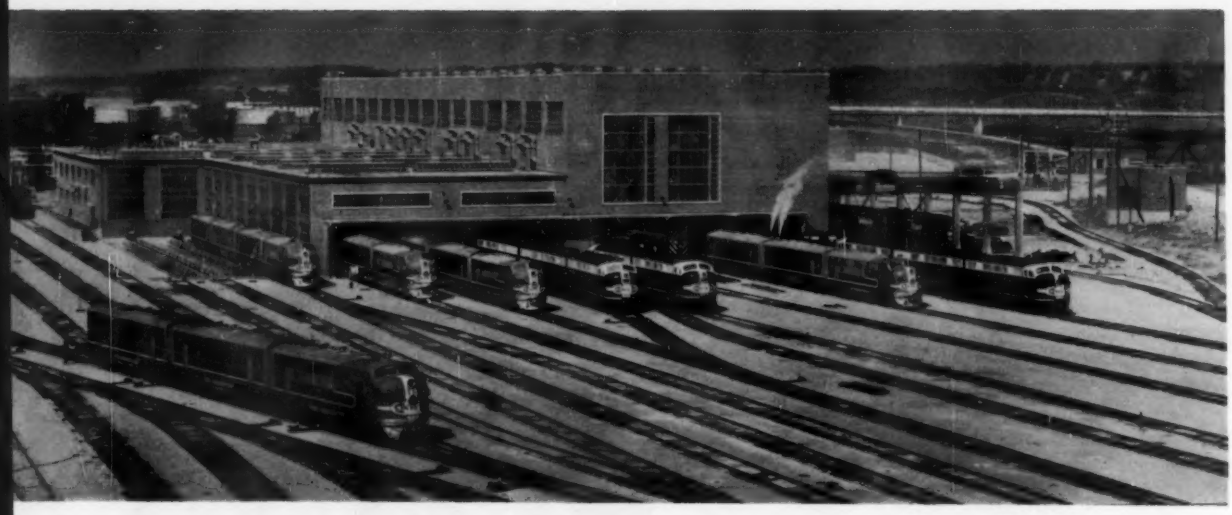
Fuel injection equipment is handled in another section of the shop. Injector testing apparatus is shown at right with cleaning tank to left of it. The fuel pump calibration stand was also built in the shop.

Chassis (above) and engine (below) dynamometers are located along the rear wall of the building. Chassis dynamometer is used for power checks on rigs in for tune-up or just rebuilt. Each rebuilt engine is run-in and checked on the engine dynamometer.



Principal Shop Equipment

Mechanic's hand tools	Snap-On Tools Corp.
Valve servicing equipment	Cedar Rapids Engineering Co.
Chassis dynamometer	Clayton Mfg. Co.
Engine dynamometer	Taylor Dynamometer and Machine Co.
Injection equipment cleaning tank	Practical Products Co.
Lathe converter	Master Mfg. Co.
Impact wrenches	Ingersoll-Rand Co.
Cleaning solvent	Detrex Corp.



Santa Fe's Newest Diesel Shop

Unusual crane facilities, unique ventilating and heating arrangement, outside servicing facilities, and a balloon track for speedy handling, are interesting features of this new shop.

SANTA FE has constructed a modern diesel maintenance and repair shop at Argentine, Kansas. It has been in operation for several months and will increase servicing facilities for Santa Fe's large diesel fleet. The main shop, a steel frame building of concrete and brick construction, covers an area approximately 400 ft by 238 ft. It is divided into three sections. A high bay section, used for annual inspections extends full-length along one side of the building. A low bay section used for other periodic inspections and lighter repairs extends along the other side for about half the building length. A 2-story portion houses a cleaning room, machine shop, storerooms, offices, and utility rooms.

The high bay section contains three tracks with full-length inspection pits spaced 30 ft on centers. This allows plenty of room for working and handling the larger parts between tracks. This bay is used for annual inspections and is served by three overhead traveling cranes. Two cranes have 125-ton main and 15-ton auxiliary hoists each; the third, a 15-ton main and 5-ton auxiliary hoist. The two 125-ton hoists are capable of lifting an entire locomotive unit when used together. This is unusual for diesel shops except where converted from heavy repair shops for steam locomotives. Only one track has an elevated platform at engineroom level and a short section at unit roof level.

In the low bay section there are four stalls with stub end 4-unit tracks. In addition, two outside tracks equipped with ramps handle any overflow of running repairs. This section is used for semi-monthly, monthly, quarterly, and semi-annual inspections and associated work. Generally, conventional platforms at the engineroom floor level, depressed floor between tracks, and deep pits between rails, were provided in this section. One stall has a platform at unit roof level.

Pits are equipped with color-coded pipelines for supplying air, steam, lubricating oil, and water (both clear and treated), and for draining off used oil and water. Each of two pairs of tracks are served by a 5-ton overhead tram beam hoist.

Ventilation to adequately remove exhaust fumes and yet provide satisfactory heating at working levels seems to have been solved in the design of this shop. Exhaust gases rise when hot and settle again as they cool. Fresh air intakes were placed along a side wall of both bays at about the level of the top of the locomotive unit. Exhaust fans in the roof of the building draw this fresh air in under the diesel engine exhaust gases as they rise. In this manner the diesel fumes are carried along with the fresh air as it is pulled out through the roof exhaust fans. The air at shop floor level remains relatively still and is not contaminated.

Heating is supplied in both bay sections by radiant floor hot water heat, supplemented by low-pressure steam

radiators. De-icer radiators are placed at intervals in the pits so that snow and ice accumulations are melted from the equipment in winter.

The Two-Story Section

First floor of this section includes machine and reconditioning shop, parts cleaning room, small parts storeroom, as well as offices for diesel shop and stores departments. The cleaning section is well equipped with tanks for cleaning pistons, heads, liners, small engine parts and filters. A Farr filter machine for cleaning air filters is used here.

In the machine shop, reconditioning of pistons, liners, heads, rods, injectors, governors, cooling fans and blowers, water and oil pumps, and all miscellaneous small parts is done. Electrical parts such as contactors, relays, and many other similar parts are also repaired and rebuilt in this shop.

The second floor is used for a heavy parts storeroom, offices of the master mechanic and general foreman of the area, their office staffs, locker, lunch, and other utility rooms. Two elevators serve this floor.

Outside Servicing

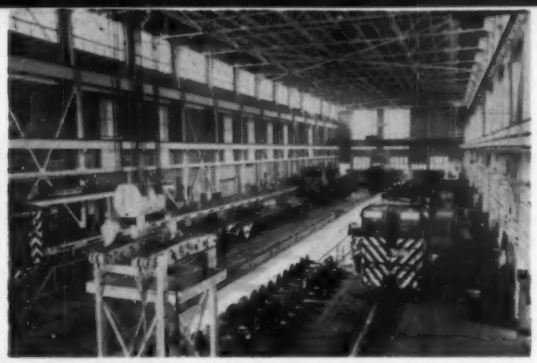
Servicing facilities adjacent to the main shop include sand towers; truck spray, fuel rack and washing machine; all aligned for progressive speedy operations. Only two dead stops are made as equipment passes through these facilities. The first is at the sanding station. As the locomotive moves slowly away from the sanding stop, an automatic truck spray cleaning solution is applied to the trucks.

This solution is allowed to remain on the trucks to soften the grease and road grime for the 10 to 15 minutes when refueling takes place. At the fuel station stop, fuel and water tanks are filled, lubricating oil checked and replenished as necessary. Engine rooms are cleaned, brakes adjusted, and miscellaneous inspection work is performed here.

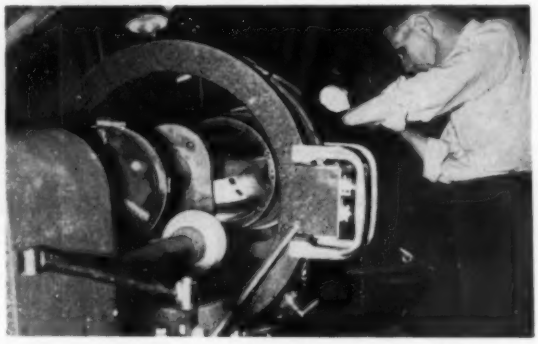
Trucks are then rinsed with a 300-psi water spray to remove cleaning solution with the loosened dirt, and the locomotive moves into the Whiting washing machine. Mechanical body washing is commenced by plain water sprays, then cleaning solution sprays, rotary brush scrubbing, and rinsing sprays. This is followed by rotary brush rinse scrubbing, and finally by two rinsing sprays. Switchers can bypass the washing machine.

The locomotive is then ready for service and moves to departure or storage tracks. If it has only one "A" unit with an operating cab, it will likely proceed around the balloon track which circles the main shop building.

Annual inspections are performed on 130 to 150 switchers and seven passenger locomotives. Other periodic inspections such as semi-monthly, monthly, quarterly, and semi-annual examinations are performed on about 400 diesel units. The number of diesel units serviced here every 24 hours amounts to between 140 and 180. This is an average of at least one every 10 minutes.

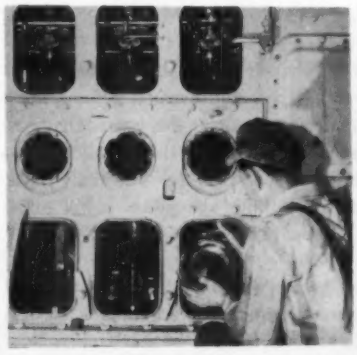


Annual inspections and resulting work is performed in the high bay section of the shop. Only one track has a engineroom level platform.

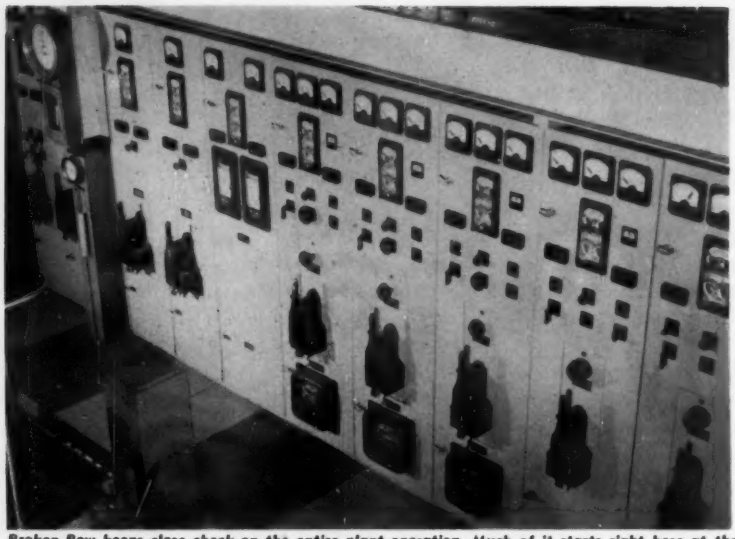


A magnaglow inspection unit is used to search for flaws in liners, heads, connecting rods, pistons, etc. Imperfections are clearly visible.

Pistons, heads, liners, injectors, nozzles, and all small parts for diesel locomotives are overhauled in this section of the shop. Parts in the foreground have been reworked and are ready for assembly.



Above, a machinist installs a piston in an O-P switch engine. Pistons are removed and overhauled every two years. At right, grinding an Alco valve in the repair parts bay.



Broken Bow keeps close check on the entire plant operation. Much of it starts right here at the control panel. Even one tenth of one mill per kw shaved off can save you a sizeable amount.

Little Things Cut Costs

By Lawrence E. Clark
Superintendent of Municipal Utilities, Broken Bow, Nebraska

At Broken Bow they start the day with a pencil, figuring yesterday's operating costs and how to shave a fraction of a mill from future operations.

"LARRY, knowing you are a good engineer, we are sure that you have watched the tubes in the oil coolers." This is part of a letter received a few days ago which prompts me to write this story.

Like most diesel plant managers, I have acquired a few friends who are associated with diesel engine manufacturers and diesel equipment suppliers. Most of these men are known only by their letters and phone conversations. The letter from one of them pointed to one of the many little things which go toward making a good operation better.

These tubes, incidentally, were not in exactly perfect condition. A study of past records revealed a very, very slow increase in oil temperatures over the years. Original efficiencies were restored only after the bundles were pulled and thoroughly cleaned. Our faces weren't quite so red, however, after reading about an Iowa plant whose coolers were worse than ours.

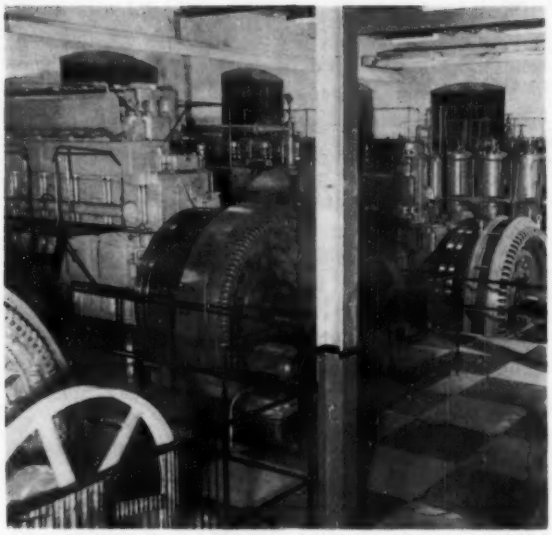
A Look at Broken Bow

First, we will summarize some of the details of the principal equipment and its operation in the Broken Bow municipal plant. Generating Unit No. 1 is a 750-hp, 500-kw, Fairbanks-Morse Model 33D16 diesel, purchased new in 1936 and now used as a standby. It will be converted to dual-fuel when increased load dictates the need.

Unit No. 2 is a 360-hp, 240-kw, Fairbanks-Morse Model 32 which was successfully converted to dual-fuel by the writer nearly two years ago. (See Diesel Power, Feb. 1954). This engine was purchased new in 1930 and is a valuable helper when paralleled with other units. Unit No. 3 is a 1200-hp, 800-kw Fairbanks-Morse Model 33E16, purchased new in 1945. This engine is an excellent unit, but is in standby service due to the higher cost of diesel fuel oil. This too will be modernized with dual-fuel equipment as soon as increased loads justify the investment.

Units No. 4 and No. 5 are respectively Enterprise DGSQ 36 and 38 dual-fuel diesels which were new in 1948 and were purchased by us secondhand in 1951. Unit No. 4 is rated at 1140 hp or 800 kw, and Unit No. 5 is rated at 1460 hp or 1000 kw. Both were converted to dual-fuel operation when installed in our plant and have since been improved further by intercooling. Incidentally, savings through the use of natural gas exceeds $36,000, per year. Therefore these two units are used for the major part of all production at this time.

Naturally there is more glamour installing big things



Three Fairbanks-Morse and two Enterprise engines are installed at Broken Bow. Engines 4 & 5 are the new Enterprise units and are at left. The three F-M engines are in the background.

in a plant to make a showing like the $36,000 above. These big things have their place and are necessary, but a few "little things" can actually add up to the biggest showing in the end.

Little Things

There is magic in those mills which compose your production cost, and in the fractions of mills which can be cut from that cost. To make our calculations easy, let us assume that we have a hypothetical plant of proportions that you may scale up or down to fit your plant. Further, let us assume that total generating costs are one cent or 10 mills per kwh, and that our plant generates 10 million kwh per year. In that case, every one-tenth of one mill reduction in generating costs results in increasing profits by $1000 per year.

Actually, it is mighty easy in many plants to cut costs one-tenth of a mill. If the manager and operators are not watching "the little things that count", these costs are probably closer to being one mill high. In other words, they are failing to save $10,000 per year. If most of the following procedures and equipment or their equal are not being used, it is possible that several mills are being lost.

Let's start our saving program by doing practically nothing for the first half hour per day. The heaviest tool to be used during this period is the pencil. This is the time to review the records of the previous day. Actual generating unit economies should be computed and compared with previous operation, etc. Unbalanced temperatures, creeping changes in pressures and temperatures (like the ones we missed in our oil coolers), can be analyzed for proper maintenance procedures.

Instruments may not appear to be "little things" when their cost is considered, yet their cost is small compared with that of the unit you are planning to operate economically. Certain basic instruments are absolutely necessary if economies are to be controlled. Some of these are integrating kwh meters, running time meters, fuel oil meters, and gas meters.

The superintendent should be familiar with the following formulas to be used in converting the information obtained from instruments into operating economy data.

$$\text{Kwh per gal} = \frac{\text{Kwh produced}}{\text{Gal fuel used}}$$

$$\text{Pilot oil Btu per kwh} = \frac{\text{Gal pilot oil used X Btu per gal}}{\text{Kwh produced}}$$

$$\text{Gas Btu per gal} = \frac{\text{Cu ft gas used X Btu per cu ft}}{\text{Kwh produced}}$$

$$\text{Gas cost per kwh} = \frac{\text{M cu ft gas used X cost per M cu ft}}{\text{Kwh produced}}$$

$$\text{Pilot oil cost per kwh} = \frac{\text{Gal pilot oil used X cost per gal}}{\text{Kwh produced}}$$

$$\text{Running capacity or load factor} = \frac{\text{Kwh produced}}{\text{Kwh nameplate rating X hr operated}}$$

$$\text{HP hr per gal lube oil} = \frac{\text{Hp nameplate rating X hr operated}}{\text{Gal lube oil used}}$$

Btu heat values of the fuel oil being used can be obtained from the suppliers, from published charts, or by test. The value presently being used in Broken Bow is 143,200 Btu per gal. Gas meters should be served at constant pressure, making it possible to use an unchanging multiplier to determine the actual cu ft consumed each day. Our multiplier is established at two and one-half times the meter reading. Values of the gas being used should probably be originally determined by sending a sample to a testing laboratory. Our natural gas tests about 900 Btu per cu ft low heat value (LHV).

A Few Things to Watch

It is hard to evaluate full dollar values derived from good maintenance because maintenance not only pays off in the current year but also adds many years to the life of the machine being operated. In the Broken Bow plant, we use a plan called "Metered Maintenance" (DIESEL POWER, Nov. 1953) in which the all-important time meter governs the various maintenance intervals. This insures the proper amount of maintenance whether a machine operates a lot or a little, and no machine is over-maintained.

Efficient loading of generating units is one avenue of saving that can really count. This is particularly true with dual-fuel equipment. Most diesel engines, when properly maintained, operate at the highest efficiency when carrying their full-rated load. In the Broken Bow case, some units were rated conservatively enough to be the most economical when carrying 10% or 15% overload.

It is obvious that it costs more for pilot oil and lubricating oil to operate two engines when one will do the job, to say nothing of extra wear and higher Btu's per

kwh. Caution should be used in loading engines over the factory rating. Unless you are absolutely sure the engines are well maintained and all temperatures and pressure are normal, it should not be attempted.

Pilot oil offers a lucrative means of lowering costs if injection pumps are adjustable, since in many areas it costs from two to three times as much as natural gas per Btu. Each adjustment toward less pilot oil should be done by small degrees and carefully observed for effect. The smaller the percentage, the more critical any changes become. A practical minimum for pilot fuel in most plants might be considered 5%. Again considering our hypothetical plant, pilot oil would then cost only about $5000 per year, leaving a very small margin for further savings.

Air-gas ratios are the original secret of dual-fuel operation, and the benefits of having these ratios just right cannot be stressed too highly. It is a mystery to this author why more manufacturers do not insist on the installation of proper equipment to determine and control air-gas ratios. Early experience at Broken Bow proved their value.

A little ingenuity plus $25 worth of material gave us a gas-flow meter which served to gauge the very best possible air-gas ratios. That was another "little thing" that saved ½ mill per kwh. In our hypothetical plant, this would have amounted to $5000 per year.

Uniform firing and compression pressures are of importance in keeping maintenance down, and keeping fuel costs low. This may also be the means of obtaining that extra 10% or 15% capacity. We use a pressure indicator to determine these pressures, although this practice is not recommended by some engine manufacturers. An indicator should never be used in dual-fuel operation when you have any reason to believe that a cylinder will misfire.

Uniform exhaust temperatures are also important, but are second to firing pressures. When properly established for various operating loads, exhaust temperatures can become a good guide from which air-gas ratios may be controlled. A number of interlocking factors enter into the balance of pressures and temperatures.

For instance, high exhaust temperatures on any cylinder may come from retarded injection timing, excessive fuel, or too little air. High firing pressures may come from advanced injection timing or excessive fuel. Each adjustment should be small and followed by a check for results, good or bad.

Keep it Clean

Good housekeeping provides another good avenue to uncover many of "the little things that count". An operator who has to continuously clean up from oil leaks will eventually do something about them. The routine of good housekeeping brings the operator regularly in close contact with all the equipment being operated. "Little things" that could count for a lot of trouble are nipped in the bud.

Your neighbor's plant, whether it be large or small, can supply a wealth of new ideas for little things that count. Occasional visits to other plants will pay dividends at home. Training schools and courses will prove their value as will publications on the diesel which contain many useful ideas for your benefit.

Factory services should be relied on for any maintenance which is too technical for your own crews or which requires greater precision than your own equipment can supply. Incidentally, the factory will supply a surprising amount of free advice for the asking.

Now in conclusion, I had better take care of another of those "little things that count" and answer that letter from a friend. It is important both from the standpoint of business and friendship to keep up those contacts.

"Dear Hank:

Thanks for the complimentary remark about Larry being a good engineer. This is being taken with a grain of salt and the oil coolers are now clean inside and out.

Sincerely,
Larry"

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 111 to check them.

1. A lightly binding injector needle valve can generally be freed by lapping the needle to the body with coarse lapping compound.
   a. True b. False

2. Which of the following is most helpful in determining the presence of lacquer on injector needles?
   a. Simply good eyesight c. A paper towel
   b. A precision micrometer d. A magnifying glass

3. Fuel gas meters should be supplied gas at constant pressure for which of the following reasons?
   a. Gives greatest accuracy of measurement
   b. To avoid damage to meter
   c. For facility in figuring consumption

4. An otoscope is an instrument commonly used by doctors. In which of the following repair jobs is it most helpful?
   a. Fitting pistons c. Checking injector seats
   b. Checking ring clearance d. Fitting bearings

5. In natural gas engines, intake air is frequently controlled to maintain a substantially constant air-fuel ratio. The principal reason for this is:
   a. To maintain constant exhaust temperatures
   b. To give better part-load fuel economy
   c. To reduce air pumping power requirements

6. Since pilot oil used in a dual-fuel engine accounts for so small a percentage of the total Btu requirement, it is not worth while to worry about reducing it.
   a. True b. False

7. When soluble oil is added to the cooling water as an inhibitor, what is the proper proportion?
   a. 1 oz per gal c. 5 oz per gal
   b. 3 oz per gal d. 8 oz per gal

ENGINE SPECIFICATIONS 1955

Diesel Dual-Fuel Natural Gas

Data on Engines Manufactured by American Diesel Engine Builders

American Locomotive Co. S-2
Baldwin-Lima-Hamilton Corp. S-2
Buda Co. S-2
Caterpillar Tractor Co. S-3
Chicago Pneumatic Tool Co. S-3
Clark Brothers Co. S-3
Climax Engine & Pump Mfg. Co. S-4
Continental Motors Corp. S-4
Cooper-Bessemer Corp. S-4
Cummins Engine Co., Inc. S-5
Enterprise Engine & Machinery Co. S-5
Fairbanks, Morse & Co. S-5
GM-Cleveland Diesel Div. S-6
GM-Detroit Diesel Engine Div. S-6
GM-Electro-Motive Div. S-7
Gray Marine Motor Co. S-7
Hallett Mfg. Co. S-7
Harnischefeger Corp., P&H Diesel Div. S-7
Hercules Motors Corp. S-7
Ingersoll-Rand Co. S-8
International Harvester Co. S-8
Kahlenberg Brothers Co. S-8
Lathrop Engine Co. S-9
Le Roi Div.-Westinghouse S-9
Lufkin Foundry & Machine Co. S-9
Mack Motor Truck Corp. S-9
Minneapolis-Moline Co. S-9
Murphy Diesel Co. S-9
National Supply Co. S-10
Superior Engines S-10
Atlas Engines S-10
Lister Engines S-10
Armstrong-Siddeley Engines S-10
Nordberg Mfg. Co. S-10
Rathbun-Jones Engineering Co. S-11
R. H. Sheppard Co., Inc. S-11
Sterling Engine Co. S-11
Sun Shipbuilding & Dry Dock Co. S-12
Union Diesel Engine Co. S-12
Waukesha Motor Co. S-12
White-Roth Machine Co. S-12
Witte Engine Works S-13
Wolverine Motor Works, Inc. S-13
Worthington Corp. S-13

Foreign Diesel Engines Being Actively Sold in This Country

Brush ABOE, Inc. S-14
Bamfords S-14
Burmeister and Wain American Corp. S-14
Crofton Industrial Diesel Engines S-14
Henschel & Sohn S-14
Klockner-Humboldt-Deutz S-15
M.A.K. S-15
M.A.N. S-16
Mercedes-Benz S-16
Sulzer Bros., Ltd. S-16

SYMBOL MEANINGS

Use

M—Marine propulsion service
S —Stationary service implying permanence of installation
P —Mobile, portable, or transportational service

Type

A—Diesel
B—Spark ignition natural gas engine
C—Diesel and dual-fuel
D—Diesel, dual-fuel, and natural gas engine

Starting System

A—Air starting
E—Electric starting
G—Gasoline engine starting
H—Hand cranking

Fuel System

O—Own manufacture
B—American Bosch
S—Bendix-Scintilla
R—Roosa-Master
D—Demco
A—Adeco

Ignition

B—Battery system
LM—Low tension magneto
HM—High tension magneto
P—Pulse generator

Supercharging Systems

M—Mechanical
T—Turbocharger

Reverse Gears

D—Direct reversing
S —Snow-Nabstedt
T—Twin Disc
C—Capitol
W—Western Gear
P—Paragon
O—Own manufacture
F—Falk

Notes:
Model numbers are for basic engines and may vary for other ratings and uses.
Dimensions are given to the next largest inch.
Dimensions and weights are for basic model unless otherwise indicated.

American Locomotive Company
30 Church Street, New York, N.Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-9 x 10¼	C	M-S-P	4	6	9 x 10¼	550-900	720-1000	B	....	E-A	T	F	144	60	89	21350
12-9 x 10½	C	M-S-P	4	12	9 x 10½	1100-1800	720-1000	B	....	E-A	T	D-F	166	69	84	31865
16-9 x 10½	C	M-S-P	4	16	9 x 10½	1470-2400	720-1000	B	....	E-A	T	D-F	189	69	84	37000
6-12½ x 13	C	S-P	4	6	12½ x 13	580-660	600-740	B	....	E-A	....	F	156	60	82	34000†
6-12½ x 13T	C	S-P	4	6	12½ x 13	810-1000	600-740	B	....	E-A	T	F	156	60	115	36000†
8-12½ x 13	C	S	4	8	12½ x 13	775-860	600-720	B	....	A	....	....	200	60	96	49000
8-12½ x 13T	C	S	4	8	12½ x 13	1080-1300	600-720	B	....	A	T	....	225	60	115	50000

† *Dimensions and weights for portable unit.*

Baldwin-Lima-Hamilton Corp.
Hamilton, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
T-495-SA	A	M-S-P	4	4	9½ x 12	530-700	720-950	D	....	A-E	T	C	107	51	88	19500
T-695-SA	A	M-S-P	4	6	9½ x 12	800-1050	720-950	D	....	A-E	T	C	134	51	80	22500
T-895-SA	A	M-S-P	4	8	9½ x 12	1060-1400	720-950	D	....	A-E	T	C	161	51	80	27000
606-NA	C	M-S	4	6	12¾ x 15½	430-750	360-625	B-S	....	A-E	....	D	159	76	91	35000
608-NA	C	M-S	4	8	12¾ x 15½	575-1000	360-625	B-S	....	A-E	....	D	195	76	91	43500
606-SC	C	M-S	4	6	12¾ x 15½	650-1320	360-625	B-S	....	A-E	T	D	170	86	91	36500
608-SC	C	M-S	4	8	12¾ x 15½	865-1750	360-625	B-S	....	A-E	T	D	212	89	91	45000
521-SA*	C	M-S	2	5	21½ x 27½	2400	257	B	....	A	....	D	267	80	161	175000
621-SA	C	M-S	2	6	21½ x 27½	2900	257	B	....	A	....	D	304	80	161	205000
721-SA	C	M-S	2	7	21½ x 27½	3400	257	B	....	A	....	D	341	80	161	233000
821-SA	C	M-S	2	8	21½ x 27½	3850	257	B	....	A	....	D	378	80	161	262500
921-SA	C	M-S	2	9	21½ x 27½	4350	257	B	....	A	....	D	415	80	161	292000
1021-SA	C	M-S	2	10	21½ x 27½	4850	257	B	....	A	....	D	478	80	161	321000
1221-SA	C	M-S	2	12	21½ x 27½	5450	257	B	....	A	....	D	552	80	161	380000
324-DA*	A	M-S	2	3	24 x 36	1585-3000	100-180	O	....	A	....	D	....	....	....	.....
424-DA	A	M-S	2	4	24 x 36	2115-4000	100-180	O	....	A	....	D	310	111	236	.....
524-DA	A	M-S	2	5	24 x 36	2640-5000	100-180	O	....	A	....	D	356	111	236	441000
624-DA	A	M-S	2	6	24 x 36	3170-6000	100-180	O	....	A	....	D	402	111	236	514000
724-DA	A	M-S	2	7	24 x 36	3700-7000	100-180	O	....	A	....	D	447	111	236	588000
824-DA	A	M-S	2	8	24 x 36	4225-8000	100-180	O	....	A	....	D	492	111	236	661000
924-DA	A	M-S	2	9	24 x 36	4750-9000	100-180	O	....	A	....	D	538	111	236	735000
1024-DA	A	M-S	2	10	24 x 36	5280-10000	100-180	O	....	A	....	D	583	111	236	808000

* *SA indicates single acting; DA indicates double acting.*

Weights are net for engine only.

The Buda Company
Harvey, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2BD77	A	M-S-P	4	2	3⅞ x 4½	13.4-15.8	1800-2000	B	....	E	....	S	22	23	31	500*
4BD153	A	M-S-P	4	4	3⅞ x 4½	28-34	2000-2400	B	....	E	....	S	31	23	31	680*
6BD230	A	M-S-P	4	6	3⅞ x 4½	42-60	2000-2400	B	....	E	....	S	39	23	31	850*
4BD182	A	M-S-P	4	4	3⅝ x 4½	32-59	1800-2400	B	....	E	....	S	31	23	31	710*
6BD273	A	M-S-P	4	6	3⅝ x 4½	56-85	1800-2400	B	....	E	....	S	39	23	31	890*
6DAM273	A	M	4	6	3⅝ x 4½	85	2800	B	....	E	....	S	57	24	32	995
6DT317	A	M-S-P	4	6	3¾ x 5½	56-79	1800-2300	B	....	E	....	S	42	28	41	1150*
6DT468	A	M-S-P	4	6	4¼ x 5½	76-96	1600-2000	B	....	E	....	S	48	27	40	1245*
6DTS468	A	P	4	6	4¼ x 5½	135	2400	B	....	E	M	....	48	34	42	1565
6DAS516	A	P	4	6	4⅛ x 5⅝	165	2400	B	....	E	M	....	48	34	48	1625

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6DA779	A	S-P	4	6	5¼ x 6	120–165	1400–1900	B	....	E	....	....	59	30	49	2552*
6DA844	A	M-S-P	4	6	5¼ x 6½	140–190	1200–1950	B	....	E	....	S	59	30	49	2630*
6DAS844	A	M-S-P	4	6	5¼ x 6½	155–245	1400–1950	B	....	E	M	S	59	35	49	2674*
8DA1125	A	M-S-P	4	8	5¼ x 6½	171–250	1400–1950	B	....	E	....	S	76	30	51	3400*
8DAS1125	A	M-S-P	4	8	5¼ x 6½	192–300	1400–1950	B	....	E	M	S	78	34	51	3580*
6DC970	A	S-P	4	6	5½ x 6½	140–178	1400–1800	B	....	E	....	....	59	30	49	2600*
8DC1290	A	S-P	4	8	5½ x 6½	190–243	1400–1800	B	....	E	....	....	76	30	51	3450*
6DC1879	A	M-S-P	4	6	6¾ x 8¾	171–232	900–1200	B	....	A-E	....	S	96	54	65	6925*
6DCS1879	A	M-P	4	6	6¾ x 8¾	284	1200	B	....	A-E	M	S	100	54	65	7900*
8DC2505	A	M-S	4	8	6¾ x 8¾	216–325	900–1200	B	....	A-E	....	W	149	52	92	12840**
8DCS2505	A	M-S	4	8	6¾ x 8¾	320–430	900–1200	B	....	A-E	M	W	158	64	92	13240**
4B153	B	S-P	4	4	3⅞ x 4½	41	2000	..	B-HM	E	....	....	51	23	39	780
4B182	B	S-P	4	4	3⅞ x 4½	46	2000	..	B-HM	E	....	....	51	23	39	780
6B230	B	S-P	4	6	3⅞ x 4½	57.5	2000	..	B-HM	E	....	....	57	23	39	960
6B273	B	S-P	4	6	3¾ x 4½	69	2000	..	B-HM	E	....	....	57	23	39	960
HP326	B	S-P	4	6	3¹¹⁄₁₆ x 4¾	69	1800	..	B-HM	E	....	....	61	27	46	1164
HP351	B	S-P	4	6	3¹¹⁄₁₆ x 5½	74	1800	..	B-HM	E	....	....	61	27	46	1164
K428	B	S-P	4	6	4⅛ x 4¾	97	1800	..	B-HM	E	....	....	71	32	52	1810
L525	B	S-P	4	6	4½ x 5½	96	1600	..	B-HM	E	....	....	71	32	52	1860
LO525	B	S-P	4	6	4½ x 5½	118.5	1600	..	B-HM	E	....	....	73	30	53	2050
6MO893	B	S-P	4	6	5⅛ x 6	174	1400	..	B-HM	E-G	....	....	95	39	64	3815
6MO970	B	S-P	4	6	5⅛ x 6½	188	1400	..	B-HM	E-G	....	....	95	39	64	3830
8MO1290	B	S-P	4	8	5⅛ x 6½	261	1400	..	B-HM	E-G	....	....	111	46	74	5420
8MOS1290	B	S-P	4	8	5⅛ x 6½	288	1400	..	B-HM	E-G	M	....	112	52	75	5900
6PC1879	B	S-P	4	6	6¾ x 8¾	234	1000	..	B-HM	A-E-G	....	....	123	48	83	9100
6PCS1879	B	S-P	4	6	6¾ x 8¾	292	1000	..	B-HM	A-E-G	M	....	132	60	89	11050
8PC2505	B	S-P	4	8	6¾ x 8¾	362	1000	..	B-HM	A-E-G	....	....	141	64	93	12640
8PCS2505	B	S-P	4	8	6¾ x 8¾	440	1000	..	B-HM	A-E-G	M	....	150	64	88	14289

** Weights and dimensions for portable units. ** Weights and dimensions for stationary units. All diesel engines have Laneva combustion system.*

Caterpillar Tractor Company
Peoria, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-311	A	M-S-P	4	4	4 x 5	38–57	1600–2000	O	....	E-G	....	T	58	27	51	1800
D-315	A	M-S-P	4	4	4½ x 5½	56–82	1600–2000	O	....	E-G	....	S-T	60	30	50	2200
D-318	A	M-S-P	4	6	4½ x 5½	80–119	1600–2000	O	....	E-G	....	S-T	67	31	50	3100
D-326	A	M-S-P	4	6	5⅛ x 6	121–170	1600–2000	O	....	A-E-G	....	S	72	34	52	3655
D-337	A	M-S-P	4	6	5¼ x 6	170–250	1600–2000	O	....	A-E-G	M	S	72	37	64	4100
D-8800	A	M-S-P	4	4	5¼ x 8	82–102	1000	O	....	A-E-G	....	S-T	67	39	67	4275
D-13000	A	M-S-P	4	6	5¼ x 8	150–190	1225	O	....	A-E-G	....	S-T	85	43	67	5300
D-364	A	M-S-P	4	V-8	5¼ x 8	235–275	1225–1300	O	....	A-E	....	S-T	84	55	77	8240
D-375	A	M-S-P	4	V-8	5¼ x 8	300–350	1225–1300	O	....	A-E	M	S	83	54	79	8655
D-386	A	M-S-P	4	V-12	5¼ x 8	360–415	1225–1300	O	....	A-E	....	F	104	54	79	10780
D-397	A	M-S-P	4	V-12	5¼ x 8	450–520	1225–1300	O	....	A-E	M	S	107	54	93	11290

High end of horsepower range is maximum. Lower end is for continuous, 24-hr. duty. D-397, D-375 & D-337 equipped with Roots blower. Weights and dimensions are for "S" & "P" units. Widths include sump pump handle extended, starting crank, etc. All engines available as electric sets. All engines have "Cat" fuel system—solid injection, precombustion chamber type.

Chicago Pneumatic Tool Company
6 East 44th Street, New York 17, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight
39-CP	D	S	4	3	9 x 10½	145	720	S	LM	A	....	....	68	44	67	8900
49-CP	D	S	4	4	9 x 10½	195	720	S	LM	A	....	....	84	44	67	10690
69-CP	D	S	4	6	9 x 10½	290	720	S	LM	A	....	....	112	44	67	14240
89-CP	D	S	4	8	9 x 10½	390	720	S	LM	A	....	....	140	44	67	16750
412-CP	D	S	4	4	11 x 12	330	720	S	LM	A	....	....	106	47	95	21200
512-CP	D	S	4	5	11 x 12	415	720	S	LM	A	....	....	124	55	95	25800
612-CP	D	S	4	6	11 x 12	500	720	S	LM	A	....	....	142	55	95	28400
812-CP	D	S	4	8	11 x 12	665	720	S	LM	A	....	....	178	68	95	32800
614-CP	D	S	4	6	11 x 14¼	495	600	S	LM	A	....	....	143	58	95	29800
814-CP	D	S	4	8	11 x 14¼	655	600	S	LM	A	....	....	178	68	95	34500
460-CP	D	S	4	4	16 x 20	585	360	S	LM	A	....	....	171	85	125	64700
462-CP	D	S	4	4	16 x 22	585	327	S	LM	A	....	....	171	85	125	64700
560-CP	D	S	4	5	16 x 20	730	360	S	LM	A	....	....	197	85	125	72800
562-CP	D	S	4	5	16 x 22	730	327	S	LM	A	....	....	197	85	125	72800
660-CP	D	S	4	6	16 x 20	875	360	S	LM	A	....	....	223	85	125	80900
662-CP	D	S	4	6	16 x 22	870	327	S	LM	A	....	....	223	85	125	80900
860-CP	D	S	4	8	16 x 20	1170	360	S	LM	A	....	....	275	106	125	101440
862-CP	D	S	4	8	16 x 22	1170	327	S	LM	A	....	....	275	106	125	101440
69-CPS	D	S	4	6	9 x 10½	435	720	S	LM	A	T	....	156	58	84	15740
89-CPS	D	S	4	8	9 x 10½	585	720	S	LM	A	T	....	184	58	84	18250
412-CPS	D	S	4	4	11 x 12	500	720	S	LM	A	T	....	128	47	113	23400
512-CPS	D	S	4	5	11 x 12	620	720	S	LM	A	T	....	146	55	113	27500
612-CPS	D	S	4	6	11 x 12	745	720	S	LM	A	T	....	164	55	113	31600
812-CPS	D	S	4	8	11 x 12	1000	720	S	LM	A	T	....	215	68	113	35700
614-CPS	D	S	4	6	11 x 14¼	740	600	S	LM	A	T	....	164	55	113	32000
814-CPS	D	S	4	8	11 x 14¼	985	600	S	LM	A	T	....	215	68	113	36000
460-CPS	D	S	4	4	16 x 20	875	360	S	LM	A	T	....	210	85	125	68130
462-CPS	D	S	4	4	16 x 22	875	327	S	LM	A	T	....	210	85	125	68130
560-CPS	D	S	4	5	16 x 20	1100	360	S	LM	A	T	....	236	106	125	76540
562-CPS	D	S	4	5	16 x 22	1100	327	S	LM	A	T	....	236	106	125	76540
660-CPS	D	S	4	6	16 x 20	1315	360	S	LM	A	T	....	262	106	125	84950
662-CPS	D	S	4	6	16 x 22	1315	327	S	LM	A	T	....	262	106	125	84950
860-CPS	D	S	4	8	16 x 20	1750	360	S	LM	A	T	....	320	116	125	106800
862-CPS	D	S	4	8	16 x 22	1750	327	S	LM	A	T	....	320	116	125	106800

Clark Bros. Co.
Olean, New York

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RAD2	A	S	2	2	14 x 14	200	330	B-S	....	A	....	....	....	....	....	28700
RAD32	A	S	2	3	14 x 14	300	330	B-S	....	A	....	....	....	....	....	33850
RAD4	A	S	2	4	14 x 14	400	330	B-S	....	A	....	....	....	....	....	42700
RAD5	A	S	2	5	14 x 14	500	330	B-S	....	A	....	....	....	....	....	52700

(Specifications continued on next page)

Clark *(Continued from preceding page)*

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
RAD6	A	S	2	6	14 x 14	600	330	B-S	....	A	....	....	....	....	....	65550
RAD8	A	S	2	8	14 x 14	800	330	B-S	....	A	....	....	....	....	....	70400
DG4	A	M-S	2	4	12½ x 16	380–500	300–400	B-S	....	A	....	....	....	....	....	42000*
DG5	A	S	2	5	12½ x 16	475–675	300–400	B-S	....	A	....	....	....	....	....	.....
DG6	A	M-S	2	6	12½ x 16	570–750	300–400	B-S	....	A	....	....	....	....	....	56000*
DG8	A	S	2	8	12½ x 16	760–1000	300–400	B-S	....	A	....	....	....	....	....	.....
HMA-2	B	S-P†	2	2	8¼ x 8¼	85	600	..	LM	A	....	....	....	....	....	.....
HMA-4	B	S-P†	2	4	8¼ x 8¼	175	600	..	LM	A	....	....	....	....	....	.....
HMA-6	B	S-P†	2	6	8¼ x 8¼	265	600	..	LM	A	....	....	....	....	....	.....
HMA-8	B	S-P†	2	8	8¼ x 8¼	350	600	..	LM	A	....	....	....	....	....	.....
HMA-10	B	S-P†	2	10	8¼ x 8¼	440	600	..	LM	A	....	....	....	....	....	.....
HSRA-3	B	S	2	3	14 x 14	440	330	..	LM	A	M	....	....	....	....	.....
HSRA-4	B	S	2	4	14 x 14	600	330	..	LM	A	M	....	....	....	....	.....
HSRA-5	B	S	2	5	14 x 14	725	330	..	LM	A	M	....	....	....	....	.....
HSRA-6	B	S	2	6	14 x 14	880	330	..	LM	A	M	....	....	....	....	.....
HSRA-8	B	S	2	8	14 x 14	1200	330	..	LM	A	M	....	....	....	....	.....
HRA-8	B	S	2	8	14 x 14	1055	330	..	LM	A	....	....	....	....	....	.....
TRA-6	B	S	2	6	14 x 14	1200	360	..	LM	A	T	....	....	....	....	.....
TRA-7	B	S	2	7	14 x 14	1380	360	..	LM	A	T	....	....	....	....	.....
TRA-8	B	S	2	8	14 x 14	1600	360	..	LM	A	T	....	....	....	....	.....
TRA-10	B	S	2	10	14 x 14	2000	360	..	LM	A	T	....	....	....	....	.....
HBA-5	B	S	2	5	17 x 17	1200	330	..	LM	A	....	....	....	....	....	.....
HBA-6	B	S	2	6	17 x 17	1440	330	..	LM	A	....	....	....	....	....	.....
HBA-8	B	S	2	8	17 x 17	1920	330	..	LM	A	....	....	....	....	....	.....
HBA-10	B	S	2	10	17 x 17	2400	330	..	LM	A	....	....	....	....	....	.....
TLA-6	B	S	2	6	17 x 19	2000	300	..	LM	A	T	....	....	....	....	.....
TLA-7	B	S	2	7	17 x 19	2350	300	..	LM	A	T	....	....	....	....	.....
TLA-8	B	S	2	8	17 x 19	2700	300	..	LM	A	T	....	....	....	....	.....
TLA-10	B	S	2	10	17 x 19	3300	300	..	LM	A	T	....	....	....	....	.....

* *Marine weight.* † *Semi portable.* *All engines have open type combustion chambers.*

Climax Engine & Pump Mfg. Co.
Clinton, Iowa

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
R110	B	S-P	4	4	6¼ x 7	.....	900	..	B-HM	A-E-G	....	....	58	31	49	2450
R165	B	S-P	4	6	6¼ x 7	.....	900	..	B-HM	A-E-G	....	....	74	30	51	3250
K67	B	S-P	4	6	7 x 7	.....	900	..	B-HM	A-E-G	....	....	71	30	58	5400
K75	B	S-P	4	6	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	71	30	58	5400
V80	B	S	4	8	7 x 7	.....	900	..	B-HM	A-E-G	....	....	79	51	59	8400
V85	B	S	4	8	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	79	51	59	8600
V122	B	S	4	12	7 x 7	.....	900	..	B-HM	A-E-G	....	....	103	51	59	11000
V125	B	S	4	12	7⅛ x 7	.....	900	..	B-HM	A-E-G	....	....	103	51	59	11600
C46	B	S	4	1	5 x 6¼	.....	600	..	HM	H-E-G	....	....	47	38	39	1360
C66	B	S	4	1	5¾ x 7⅛	.....	550	..	HM	H-E-G	....	....	58	40	44	1575
C96	B	S	4	1	7 x 8½	.....	500	..	HM	H-E-G	....	....	62	47	49	2580

Continental Motors Corporation
Muskegon, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ZD129	A	S**	4	4	3¼ x 3⅞	29.9	2000	R	....	E	....	....	...	...	...	485
GD157	A	M-S-P	4	4	3⅝ x 4⅜	39	2000	R-B	....	E	....	....	32	16	31	605
ED201	A	S**	4	4	3⅝ x 4½	45.7	2000	R-B	....	E	....	....	...	...	...	655
HD243	A	S-P	4	4	3¾ x 5⅛	54.7	2000	R-B	....	E	....	....	34	22	35	840
HD260	A	S**	4	4	3⅞ x 5½	59.3	2000	R-B	....	E	....	....	34	22	35	840
HD277	A	S**	4	4	4 x 5½	63	2000	R-B	....	E	....	....	34	22	35	850
JD382	A	S**	4	4	4½ x 6	72.5	1600	B	....	E	....	....	...	...	...	925
TD427	A	S	4	6	4⅝ x 4⅞	106.5	2000	B	....	E	....	....	47	25	36	1300
RD572	A	S	4	6	4¾ x 5⅜	142.5	2000	B	....	E	....	....	52	30	43	1845
VD603	A	S	4	8	4¾ x 4¼	175	2600	R	....	E	....	....	44	34	47	1696
SD802	A	S	4	6	5⅛ x 5½	202	1800	B	....	E	....	....	...	...	...	2160
TD6427	A	M-P	4	6	4⅝ x 4⅞	116	2400	B	....	E	....	....	47	25	36	1270
RD6572	A	M-P	4	6	4¾ x 5⅜	162	2400	B	....	E	....	....	52	30	46	1785
VD8603	A	P	4	8	4¾ x 4¼	182	2800	R	....	E	....	....	44	34	47	1680
SD6802	A	M-P	4	6	5⅛ x 5½	225	2200	B	....	E	....	....	...	...	...	2140
Y-69	B	S-P	4	4	2⅛ x 3⅛	16.3*	2000	..	B-LM-HM	E	....	....	26	15	26	265
Y-112	B	S-P	4	4	3⅛ x 3⅛	28*	2000	..	B-LM-HM	E	....	....	26	15	26	265
F-162	B	S-P	4	4	3⅛ x 4⅜	38*	2000	..	B-LM-HM	E	....	....	29	16	29	370
F-226	B	S-P	4	6	3⅛ x 4⅜	58*	2000	..	B-LM-HM	E	....	....	36	16	29	510
M-330	B	S-P	4	6	4 x 4⅜	78.5*	2000	..	B-LM-HM	E	....	....	43	22	34	725
B-427	B	S-P	4	6	4⅛ x 4⅞	101.5*	2000	..	B-LM-HM	E	....	....	46	22	34	870
R-501	B	S-P	4	6	4½ x 5¼	129*	2000	..	B-LM-HM	E	....	....	52	28	45	1670
R-602	B	S-P	4	6	4⅝ x 5⅜	152*	2000	..	B-LM-HM	E	....	....	52	28	45	1670
S-749	B	S-P	4	6	5¼ x 5½	190*	2000	..	B-LM-HM	E	....	....	58	28	48	1910

*Horsepower Given is Bare Engine Rating **Available for Industrial Applications only.

The Cooper-Bessemer Corporation
Mt. Vernon, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
FW6	A	M-S-P	4	6	9 x 10½	430	1000	S	....	A	....	O	130	35	80	17800
FW6T	A	M-S-P	4	6	9 x 10½	835	1000	S	....	A	T	O	176	35	80	18300
FVA8	A	M-S-P	4	8	9 x 10½	575	1000	S	....	A	....	O	102	44	58	22000
FVA8T	A	M-S-P	4	8	9 x 10½	1110	1000	S	....	A	T	O	124	44	58	27240
FVA12	A	M-S-P	4	12	9 x 10½	860	1000	S	....	A	....	O	140	44	58	26000
FVA12T	A	M-S-P	4	12	9 x 10½	1670	1000	S	....	A	T	O	140	44	58	37800
FVA16	A	M-S-P	4	16	9 x 10½	1150	1000	S	....	A	....	O	165	44	58	32000
FVA16T	A	M-S-P	4	16	9 x 10½	2330	1000	S	....	A	T	O	165	44	58	46480
GS6	D	M-S	4	6	10½ x 13½	565	750	O	B	A	....	D	142	38	68	21500
GS6T	D	M-S	4	6	10½ x 13½	1090	750	O	B	A	T	D	174	38	68	22250
GS8	D	M-S	4	8	10½ x 13½	775	750	O	B	A	....	D	175	38	68	29500
GS8T	D	M-S	4	8	10½ x 13½	1460	750	O	B	A	T	D	206	38	68	30250
JS6	D	S	4	6	13 x 16	515	450	O	B	A	....	....	149	45	80	41000

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
JS6	D	M-S	4	6	13 x 16	705	514	O	B	A	....	D	171	45	80	44000
JS6T	D	M-S	4	6	13 x 16	1360	514	O	B	A	T	D	200	45	80	45000
JS7	D	S	4	7	13 x 16	820	514	O	B	A	....	....	193	45	80	48000
JS7T	D	S	4	7	13 x 16	1585	514	O	B	A	T	....	221	45	80	49000
JS8	D	M-S	4	8	13 x 16	935	514	O	B	A	....	D	210	45	80	51000
JS8T	D	M-S	4	8	13 x 16	1815	514	O	B	A	T	D	239	45	80	52000
LS6	D	M-S	4	6	15½ x 22	965	360	O	B	A	....	D	224	56	120	76000
LS6T	D	M-S	4	6	15½ x 22	1870	360	O	B	A	T	D	251	56	120	77000
LS7	D	S	4	7	15½ x 22	1125	360	O	B	A	....	....	248	56	120	91000
LS7T	D	S	4	7	15½ x 22	2180	360	O	B	A	T	....	270	56	120	92000
LS8	D	M-S	4	8	15½ x 22	1285	360	O	B	A	....	D	276	56	120	106000
LS8T	D	M-S	4	8	15½ x 22	2500	360	O	B	A	T	D	299	56	120	107000
LSV12	D	M-S	4	12	15½ x 22	1925	360	O	B	A	....	D	252	68	117	194500
LSV12T	D	M-S	4	12	15½ x 22	3740	360	O	B	A	T	D	300	68	117	197500
LSV16	D	M-S	4	16	15½ x 22	2565	360	O	B	A	....	D	307	68	117	232500
LSV16T	D	M-S	4	16	15½ x 22	5000	360	O	B	A	T	D	355	68	117	237500

Engines have open combustion chamber. Height is given above shaft. Width is between bolt centers. All weights and dimensions for stationary units.

Cummins Engine Company, Inc.
Columbus, Indiana

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
J-6	A	M-S-P	4	6	4¼ x 5	95	1800	O	....	E	....	T	48	27	37	1400†
JF-6	A	M-S-P	4	6	4½ x 5	110	2200	O	....	E	....	T	48	27	37	1450†
JN-6	A	M-S-P	4	6	4½ x 5	125	2500	O	....	E	....	T	48	27	37	1475†
NHC-4	A	M-S-P	4	4	5½ x 6	120	1800	O	....	E	....	T	42	30	47	1690†
JT-6	A	M-S-P	4	6	4½ x 5	165	2500	O	....	E	T	S	48	33	40	1615†
JNS-6	A	M-S-P	4	6	4½ x 5	165	2500	O	....	E	M	S	48	25	40	1600†
NT-6	A	M-S-P	4	6	5½ x 6	235	2100	O	....	E	T	C	61	36	47	2546†
NRT-6	A	M-S-P	4	6	5½ x 6	335	2100	O	....	E	T	C	61	36	47	2546†
HRC-400	A	M-S-P	4	4	5½ x 6	110	1800	O	....	E	....	T	42	30	47	1640†
JS-600	A	M-P	4	6	4½ x 5	150	2500	O	....	E	M	....	47	25	40	1545†
H-600	A	M-S-P	4	6	4½ x 6	150	1800	O	....	E	....	T	57	30	46	2395†
HR-600	A	M-S-P	4	6	5½ x 6	165	1800	O	....	E	....	T	57	30	46	2400†
HRF-600	A	P	4	6	5½ x 6	175	2000	O	....	E	....	....	61	30	49	2450†
HS-600	A	S-P	4	6	4½ x 6	200	1800	O	....	E	M	T	58	32	47	2580†
NH-600	A	M-S-P	4	6	5½ x 6	200	2100	O	....	E	....	T	59	41	63	2480†
NHH-600	A	P	4	6	5½ x 6	200	2100	O	....	E	....	....	64	55	23	2285†
HRS-600	A	M-S-P	4	6	5½ x 6	225	1800	O	....	E	M	T	58	32	47	2580†
NHS-600	A	M-S-P	4	6	5½ x 6	275	2100	O	....	E	M	C	59	41	61	2775
NHRS-600	A	M-S-P	4	6	5½ x 6	300	2100	O	....	E	M	C	59	41	61	2725†
NHHRS-600	A	P	4	6	5½ x 6	300	2100	O	....	E	M	....	64	55	23	2580†
NVH-1200	A	M-S-P	4	12	5¾ x 6	400	2100	O	....	E	....	S	73	41	55	4300†
NVHS-1200	A	M-S-P	4	12	5¾ x 6	550	2100	O	....	E	M	S	73	42	55	4550†
VT-12	A	M-S-P	4	12	5¾ x 6	600	2100	O	....	E	T	C	84	45	60	6120*
L-600	A	M-S	4	6	7 x 10	250	1000	O	....	A-E	....	C	92	44	58	7590*
LR-600	A	M-S	4	6	7¼ x 10	300	1100	O	....	A-E	....	C	92	44	58	7590*
LR-600GAS	B	S	4	6	7¼ x 10	315	1100	..	HM	A-E	....	....	92	44	58	7590*

All except "L" models suitable for automotive and other portable applications.
*† Automotive weight with all accessory equipment; also approx. weight of stationary engine w/o radiator or clutch and approx. weight of marine engine w/o reverse gear. * Stationary engine and approx. marine weight w/o reverse gear. Hp. and RPM are maximum ratings.*

Enterprise Engine & Machinery Co.
Subsidiary of General Metals Corp.
18th & Florida Streets, San. Francisco, Calif.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DM3	D*	M-S-P	4	3	8 x 10	73-162	450-1000	S	LM-P	A-E	....	**	55	43	66	5600
DM33	D	M-S-P	4	3	8 x 10	137-305	450-1000	S	LM	A-E	T	**	55	43	73	5900
DM4	D	M-S-P	4	4	8 x 10	97-216	450-1000	S	LM	A-E	....	**	67	43	66	7900
DM34	D	M-S-P	4	4	8 x 10	183-406	450-1000	S	LM	A-E	T	**	67	43	73	8300
DM6	D	M-S-P	4	6	8 x 10	146-324	450-1000	S	LM	A-E	....	**	91	43	66	10800
DM36	D	M-S-P	4	6	8 x 10	274-609	450-1000	S	LM	A-E	T	**	91	43	74	11400
DM8	D	M-S-P	4	8	8 x 10	194-432	450-1000	S	LM	A-E	....	**	116	43	68	13700
DM38	D	M-S-P	4	8	8 x 10	366-812	450-1000	S	LM	A-E	T	**	116	43	82	15600
DG-6	D	M-S-P	4	6	12 x 15	275-655	250-600	S	LM	A	....	D	145	47	96	33500
DG-36	D	M-S-P	4	6	12 x 15	482-1157	250-600	S	LM	A	T	D	145	47	96	34600
DG-8	D	M-S-P	4	8	12 x 15	364-874	250-600	S	LM	A	....	D	179	47	96	42700
DG-38	D	M-S-P	4	8	12 x 15	643-1542	250-600	S	LM	A	T	D	179	47	96	44660
DQ-6	D	M-S-P	4	6	16 x 20	647-971	250-375	S	LM	A	....	D	206	60	124	77300
DQ-36	D	M-S-P	4	6	16 x 20	1142-1713	250-375	S	LM	A	T	D	206	60	124	79500
DQ-8	D	M-S-P	4	8	16 x 20	863-1295	250-375	S	LM	A	....	D	252	60	124	95410
DQ-38	D	M-S-P	4	8	16 x 20	1523-2285	250-375	S	LM	A	T	D	252	60	124	97810
DR-6	D	M-S-P	4	6	17 x 21	767-1151	250-375	S	LM	A	....	D	206	60	124	79800
DR-36	D	M-S-P	4	6	17 x 21	1354-2031	250-375	S	LM	A	T	D	206	60	124	82400
DR-8	D	M-S-P	4	8	17 x 21	1023-1535	250-375	S	LM	A	....	D	252	60	124	97200
DR-38	D	M-S-P	4	8	17 x 21	1805-2708	250-375	S	LM	A	T	D	252	60	124	99800
DRV-12	D	M-S-P	4	12	17 x 21	1228-2453	200-400	S	LM	A	....	D	197	96	145	142600
DRV-12-3	D	M-S-P	4	12	17 x 21	2311-4622	200-400	S	LM	A	T	D	197	96	145	147900
DRV-16	D	M-S-P	4	16	17 x 21	1637-3274	200-400	S	LM	A	....	D	245	96	145	181800
DRV-16-3	D	M-S-P	4	16	17 x 21	3081-6162	200-400	S	LM	A	T	D	245	96	145	189100

**All models available with trifuel equipment* ***Reverse and reduction gear used—make varies.*

Fairbanks, Morse & Company
600 S. Michigan Avenue, Chicago, Ill.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
31A6¼	A	M-S-P	2	5	6¼ x 9	175	720	O	....	A	....	D	...	...	...	.....
31A6½	A	M-S-P	2	6	6¼ x 9	210	720	O	....	A	....	D	...	...	...	.....
31A6¼	A	M-S-P	2	7	6¼ x 9	245	720	O	....	A	....	D	...	...	...	.....
31A6¼	A	M-S-P	2	8	6¼ x 9	280	720	O	....	A	....	D	...	...	...	.....
31A8½	C	M-S-P	2	5	8½ x 11	300-325	514-525	O	....	A	....	D	...	...	...	.....
31A8½	C	M-S-P	2	6	8½ x 11	360-390	514-525	O	....	A	....	D	...	...	...	.....
31A8½	C	M-S-P	2	7	8½ x 11	420-455	514-525	O	....	A	....	D	...	...	...	.....
31A8½	C	M-S-P	2	8	8½ x 11	480-520	514-525	O	....	A	....	D	...	...	...	.....
31A18	C	S	2	6	18 x 27	2100	277	O	....	A	....	....	...	...	...	.....
31A18	C	S	2	8	18 x 27	2800	277	O	....	A	....	....	...	...	...	.....

(Specifications continued on next page)

Fairbanks-Morse (Continued from preceding page)

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
1A18	C	S	2	10	18 x 27	3500	277	O	....	A	....	....	...	...	...	.....
32E12	A	S	2	2	12 x 15	120	360	O	....	A	....	....	...	...	...	.....
32E12	A	S	2	3	12 x 15	180	360	O	....	A	....	....	...	...	...	.....
32E14	A	S	2	2	14 x 17	150	300	O	....	A	....	....	...	...	...	.....
32E14	A	S	2	3	14 x 17	225	300	O	....	A	....	....	...	...	...	.....
32E14	A	S	2	4	14 x 17	300	300	O	....	A	....	....	...	...	...	.....
32E14	A	S	2	5	14 x 17	375	300	O	....	A	....	....	...	...	...	.....
32E14	A	S	2	6	14 x 17	450	300	O	....	A	....	....	...	...	...	.....
38F12	A	S	2	5	12 x 15	500	400	O	....	A	....	....	...	...	...	.....
38F12	A	S	2	6	12 x 15	600	400	O	....	A	....	....	...	...	...	.....
38F14	A	S	2	5	14 x 17	575	300	O	....	A	....	....	...	...	...	.....
38F14	A	S	2	6	14 x 17	690	300	O	....	A	....	....	...	...	...	.....
38F14	A	S	2	7	14 x 17	805	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	4	16 x 20	800	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	5	16 x 20	1000	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	6	16 x 20	1200	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	7	16 x 20	1400	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	8	16 x 20	1600	300	O	....	A	....	....	...	...	...	.....
38F16	C	S	2	10	16 x 20	2000	300	O	....	A	....	....	...	...	...	.....
37F12	A	M	2	5	12 x 15	500	400	O	....	A	....	D	...	...	...	.....
37F12	A	M	2	6	12 x 15	600	400	O	....	A	....	D	...	...	...	.....
37E14	A	M	2	5	14 x 17	575	300	O	....	A	....	D	...	...	...	.....
37E14	A	M	2	6	14 x 17	690	300	O	....	A	....	D	...	...	...	.....
37E14	A	M	2	7	14 x 17	805	300	O	....	A	....	D	...	...	...	.....
37F16	A	M	2	5	16 x 20	1000	300	O	....	A	....	D	...	...	...	.....
37F16	A	M	2	6	16 x 20	1200	300	O	....	A	....	D	...	...	...	.....
37F16	A	M	2	7	16 x 20	1400	300	O	....	A	....	D	...	...	...	.....
37F16	A	M	2	8	16 x 20	1600	300	O	....	A	....	D	...	...	...	.....
37F16	A	M	2	10	16 x 20	2125	300	O	....	A	....	D	...	...	...	.....
38F8½	D	M-S-P	2	4	5¼ x 7¼	160–330	600–1200	B	....	A-E	....	S	...	...	...	.....
38F8½	D	M-S-P	2	5	5¼ x 7¼	188–413	600–1200	B	....	A-E	....	S	...	...	...	.....
38F8½	D	M-S-P	2	6	5¼ x 7¼	225–495	600–1200	B	....	A-E	....	S	...	...	...	.....
38F8½	D	M-S-P	2	7	5¼ x 7¼	263–578	600–1200	B	....	A-E	....	S	...	...	...	.....
38F8½	D	M-S-P	2	8	5¼ x 7¼	300–660	600–1200	B	....	A-E	....	S	...	...	...	.....
38F8½	D	M-S-P	2	10	5¼ x 7¼	375–825	600–1200	B	....	A-E	....	F	...	...	...	.....
38D8½	D	M-S-P	2	4	8½ x 10	400–800	450–900	O	....	A	....	D	...	...	...	.....
38D8½	D	M-S-P	2	5	8½ x 10	500–1000	450–900	O	....	A	....	D	...	...	...	.....
38D8½	D	M-S-P	2	6	8½ x 10	600–1200	450–900	O	....	A	....	D	...	...	...	.....
39D8½	D	M-S-P	2	8	8½ x 10	800–1600	450–900	O	....	A	....	D	...	...	...	.....
38D8½	D	M-S-P	2	10	8½ x 10	1000–2000	450–900	O	....	A	....	D	...	...	...	.....
38D8½	D	M-S-P	2	12	8½ x 10	1200–2400	450–900	O	....	A	....	D	...	...	...	.....
45B3½	A	S	4	1	3½ x 4	5¼	1800	D	....	H-E	....	....	...	...	...	.....
45B4½	A	S	4	1	4½ x 4½	10½	1800	D	....	H-E	....	....	...	...	...	.....
45B4½	A	M-S	4	2	4½ x 5¼	25	1800	D	....	H-E	....	C-P	...	...	...	.....
48A3	A	M-S	4	1	3 x 4	3½	1800	O	....	E	....	S-T	...	...	...	.....
48A3½	A	M-S	4	2	3½ x 4	13½	1800	O	....	E	....	S-T	...	...	...	.....
48A4	A	S-P	4	1	4 x 5	8–11	1200–1800	O	....	E	....	S-T	...	...	...	.....
48A4	A	M-S-P	4	2	4 x 5	16–20	1200–1800	O	....	H-E	....	S-T	...	...	...	.....
48A4	A	M-S-P	4	3	4 x 5	25–30	1200–1800	O	....	H-E	....	S-T	...	...	...	.....
48A4	A	M-S-P	4	6	4 x 5	50–61	1200–1800	O	....	E	....	S-T	...	...	...	.....
48A4½	A	S-P	4	1	4¼ x 5	9–11	1200–1800	O	....	E	....	S-T	...	...	...	.....
48A4½	A	M-S-P	4	2	4¼ x 5	18–22	1200–1800	O	....	H-E	....	S-T	...	...	...	.....
48A4½	A	M-S-P	4	3	4¼ x 5	28–34	1200–1800	O	....	H-E	....	S-T	...	...	...	.....
48A4½	A	M-S-P	4	6	4¼ x 5	56–67	1200–1800	O	....	E	....	S-T	...	...	...	.....
48A4½	A	M-S-P	4	4	4½ x 5	43–78	1200–2000	O	....	E	....	S	...	...	...	.....
49B4½	A	M-S-P	2	2	4½ x 5¼	58	1800	B-S	....	A-E	....	S-T	...	...	...	.....
49B4½	A	M-S-P	2	3	4½ x 5¼	90	1800	B-S	....	A-E	....	S-T	...	...	...	.....
49B4½	A	M-S-P	2	4	4½ x 5¼	127	1800	B-S	....	A-E	....	S-T	...	...	...	.....
49B4½	A	M-S-P	2	6	4½ x 5¼	180	1800	B-S	....	A-E	....	S-T	...	...	...	.....

General Motors Corporation
Cleveland Diesel Engine Division
Cleveland, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2-268A	A	M-S	2	3	6¼ x 7	150	1200	O	....	A-E	....	....	62	41	39*	4600
4-268A	A	M-S	2	4	6¼ x 7	250	1300	O	....	A-E	....	F	72	41	39*	5400
6-268A	A	M-S	2	6	6¼ x 7	375	1300	O	....	A-E	....	F	97	41	48**	6800
8-268A	A	M-S	2	8	6¼ x 7	500	1300	O	....	A-E	....	F	117	41	48**	8800
6-278A	A	M-S	2	6	8¾ x 10½	615	750	O	....	A-E	....	F	107	54	72**	15500
8-278A	A	M-S	2	8	8¾ x 10½	820	750	O	....	A-E	....	F	124	54	72**	18800
12-278A	A	M-S	2	12	8¾ x 10½	1230	750	O	....	A-E	....	F	163	54	72**	24600
16-278A	C	M-S	2	16	8¾ x 10½	1640	750	O	....	A-E	....	F	204	54	72**	29500
16-358†	D	M-S	2	16	12½ x 14½	3000	600	O	B	E	....	F	148	141	201	62000

*† Vertical or horizontal. Heights are above crankcase. *Add 17 in. for crankcase. **Add 21 in. for crankcase. Dimensions and weights are for basic engine.*

General Motors Corporation
Detroit Diesel & Engine Division
Detroit, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
2-71	A	S-P	2	2	4.25 x 5	48	1800	O	....	E	M**	....	31	28	40	960
4-51	A	M-S-P	2	4	4.1 x 4.1	54–87	2200–3000	O	....	E	M**	P	39	28	34	1300
3-71	A	M-S-P	2	3	4.25 x 5	75–101	1800–2100	O	....	E	M**	O	37	29	41	1525
4-71	A	M-S-P	2	4	4.25 x 5	101–144	1800–2100	O	....	E	M**	O	43	29	42	1780
4-71†	A	M	2	4	4.25 x 5	95–151	1800–2300	O	....	E	M**	O	59	38	33	1920
6-71	A	M-S-P	2	6	4.25 x 5	154–223	1800–2100	O	....	E	M**	O	54	29	43	2190
6-71†	A	M	2	6	4.25 x 5	147–235	1800–2300	O	....	E	M**	O	71	38	34	2270
Twin 4-71	A	S-P	2	8	4.25 x 5	202	1800	O	....	E	M**	....	83	56	58	4820
Twin 6-71	A	M-S-P	2	12	4.25 x 5	308–447	1800–2100	O	....	E	M**	O	95	56	58	5620
Twin 6-71*	A	M	2	12	4.25 x 5	295–447	1800–2100	O	....	E	M**	O	129	38	56	7550
Quad 6-71	A	M-S-P	2	24	4.25 x 5	616–893	1800–2100	O	....	E	M**	O	128	57	53	12850
6-110	A	M-S-P	2	6	5 x 5.6	210–289	1800–2000	O	....	E	M**	O	69	32	49	2960
Twin 6-110	A	S-P	2	12	5 x 5.6	416	1800	O	....	E	M**	....	123	66	87	11440
Twin 6-110*	A	M	2	12	5 x 5.6	440–578	1800–2000	O	....	E	M**	O	146	62	69	11000

** Tandem arrangement. ** Pressure Scavenging. † Inclined engine. Weights and dimensions are given for industrial ("S" & "P") units except on engines indicated as solely for marine application. Where a horsepower range is shown, high end is "Rated" (not continuous) brake horsepower for applications such as pleasure craft, fire boats and other intermittent operation. Weights and dimensions for marine engines vary with gear selected and on "Twins" and "Quads", radiators and power take-offs are included. Torque converters are available with industrial models.*

Electro-Motive Division, General Motors Corporation
LaGrange, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-567C	A	S-P	2	6	8½ x 10	540–600	720–800	O	....	E	....	....	126	65	89	15000
8-567C	A	S-P	2	8	8½ x 10	720–900	720–835	O	....	E	....	....	142	63	89	18000
12-567C	A	S-P	2	12	8½ x 10	1080–1200	720–800	O	....	E	....	....	156	65	89	25000
16-567C	A	S-P	2	16	8½ x 10	1440–1760	720–835	O	....	E	....	....	215	63	89	31500

Engines are available for Marine use through Cleveland Diesel Engine Division, General Motors Corporation.

Gray Marine Motor Company
710 Canton Avenue, Detroit 7, Michigan

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D157	A	M	4	4	3½ x 4½	30	1800	B	....	E	....	T-S	50	25	27	1100
D260	A	M	4	4	3⅞ x 5½	50	1800	B	....	E	....	T-S	56	22	35	1400
D427	A	M	4	6	4⅛ x 4½	100	2200	B	....	E	....	P-S	61	32	35	1475
D572	A	M	4	6	4¾ x 5½	135	2200	B	....	E	....	T-S	72	23	40	2400

All data is for complete marine units.

Hallett Manufacturing Company
1601 W. Florence Avenue, Inglewood, California

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AC1	A	S	4	1	3½ x 3½	5.5	1800	B	....	H-E*	....	....	27	15	24	220
AC2	A	S	4	2	3½ x 3½	13	1800	B	....	H-E*	....	....	34	25	25	350
D1	A	M-S	4	1	3½ x 4½	8	1500	B	....	H-E*	....	S	24	20	36	450
D2	A	M-S	4	2	3½ x 4½	18	1500	B	....	E	....	S	32	28	32	565
WC1	A	S	4	1	3½ x 3½	6.5	1800	B	....	H-E*	....	....	27	15	24	250
WC2	A	M-S	4	2	3½ x 3½	12–13	1800	B	....	H-E*	....	S	34	25	25	375
WC4S	A	M-S	4	4	3½ x 3½	28	1800	B	....	E	....	S	32	27	28	535

*Engines have open combustion chamber. * Model designation refers to hand starting—"S" is added to indicate electric starting; "M" indicates marine adaption. Dimensions and weights are for basic engine.*

P & H Diesel Engine Division, Harnischfeger Corporation
500 South Main Street, Crystal Lake, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
287C-18	A	M-P	2	2	4½ x 5½	58	1800	B-D-S	....	E	M	S-T-W	33	29	41	1030
387C-18	A	M-P	2	3	4½ x 5½	90	1800	B-D-S	....	E	M	S-T-W	39	29	41	1350
487C-18	A	M-P	2	4	4½ x 5½	128	1800	B-D-S	....	E	M	S-T-W	46	29	41	1530
687C-18	A	M-P	2	6	4½ x 5½	180	1800	B-D-S	....	E	M	S-T-W	60	29	41	1900

Weights shown are for "P" units.

Hercules Motors Corporation
Canton, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
DIX83	A	M-S-P	4	2	3⅝ x 4	24¼	2200	R-B	....	H-E	....	....	22	22	31	400
DIXC	A	M-S-P	4	2	4 x 4½	27.6	1800	B	....	E	....	....	22	20	21	550
DIXD	A	M	4	2	4¼ x 4	30	1800	..	....	E	....	....	42	23	21	870
DIXD	A	M-S-P	4	2	4¼ x 4½	30	1800	B	....	E	....	....	22	20	21	550
DIX4B	A	M-S-P	4	4	3¼ x 4	38.5	2200	B	....	E	....	....	31	22	19	600
DIX4D	A	M-S-P	4	4	3½ x 4	48.5	2200	R-B	....	E	....	....	31	22	19	600
DIX4E	A	M	4	4	3⅞ x 4	75	3000	..	....	E	....	....	45	28	21	890
DIX4ES	A	M	4	4	3⅞ x 4	95	3000	..	....	E	M	....	45	32	21	990
DOOB	A	M-S-P	4	4	3¾ x 4½	48	1800	R-B	....	E-G	....	....	30	23	20	750
DOOC	A	M-S-P	4	4	4 x 4½	55	1800	B	....	E-G	....	....	30	23	20	750
DOOD	A	M-S-P	4	4	4¼ x 4½	61.5	1800	R-B	....	E-G	....	....	30	23	20	750
DIX6D	A	M-S-P	4	6	3½ x 4	77.5	2200	R-B	....	E-G	....	....	39	24	19	800
DIX6-272	A	M-S-P	4	6	3¼ x 4¼	85	2200	R-B	....	A-E-G	....	....	39	24	38	800
DIX6E	A	M	4	6	3⅞ x 4	115	3000	..	....	E	....	....	54	31	21	1380
DIX6ES	A	M	4	6	3⅞ x 4	150	3000	..	....	E	M	....	54	34	21	1490
DJXB	A	M-S-P	4	6	3½ x 4½	60	1800	R-B	....	A-E-G	....	....	37	23	21	950
DJXC&H	A	M-S-P	4	6	3¾ x 4½	69–79	1800	R-B	....	A-E-G	....	....	37	23	21	950
DJXHF	A	M-S-P	4	6	3¾ x 4½	79	1800	R-B	....	A-E-G	....	....	39	34	18 x 11	950
DWXC	A	M-S-P	4	6	4 x 4¼	94	1800	R-B	....	A-E-G	....	....	41	27	24	1350
DWXD	A	M-S-P	4	6	4¼ x 4¼	107	1800	R-B	....	A-E-G	....	....	41	27	24	1350
DWXLD	A	M-S-P	4	6	4½ x 5	112	1800	R-B	....	A-E-G	....	....	41	27	25	1350
DWXLDF	A	M-S-P	4	6	4½ x 5	106	1800	R-B	....	A-E-G	....	....	37	37	9 x 9	1325
DWXE	A	M	4	6	4⅝ x 4¾	148	2600	..	....	E	....	....	67	33	24	2200
DWXETS	A	M	4	6	4⅝ x 4¾	198	2600	..	....	E	T	....	67	33	24	2400
DRXB	A	M-S-P	4	6	4¾ x 5¼	106	1600	R-B	....	A-E-G	....	....	45	26	25	1600
DRX-501	A	M-S-P	4	6	4½ x 5¼	113	1600	R-B	....	A-E-G	....	....	47	26	39	1600
DRXC	A	M-S-P	4	6	4¾ x 5¼	118	1600	R-B	....	A-E-G	....	....	45	26	25	1600
DFXB	A	M-S-P	4	6	5 x 6	160	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXC	A	M-S-P	4	6	5¼ x 6	176	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXD	A	M-S-P	4	6	5½ x 6	191	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXE	A	M-S-P	4	6	5⅝ x 6	199	1600	R-B	....	A-E-G	....	....	56	30	31	2500
DFXETS	A	M-S-P	4	6	5⅝ x 6	258–318	1600–2000	R-B	....	A-E-G	T	....	75	28	52	2700
DFXH	A	M-S-P	4	6	5¾ x 6	220–260	1600–2100	R-B	....	A-E-G	....	....	56	30	32	2600
DFXHF	A	M-S-P	4	6	5¾ x 6	220	1600	R-B	....	A-E-G	....	....	51	49	18 x 15	2600
DNXV8-402	A	S-P	4	V-8	4 x 4	127	2200	R	....	A-E	....	....	39	33	20	1050
DNXV8C	A	M-S-P	4	V-8	6 x 6	298	1600	B	....	A-E-G	....	....	52	42	32	4200
DNXV8D	A	M-S-P	4	V-8	6¼ x 6	325–388	1600–2000	B	....	A-E-G	....	....	52	42	32	4200
DNXV8DTS	A	M-S-P	4	V-8	6¼ x 6	410–500	1600–1800	B	....	A-E-G	T	....	76	42	73	5000
BXB	B	S-P	4	2	2⅞ x 3	7.7	1800	..	B-HM	H-E	....	....	19	17	17	131
NXA	B	S-P	4	2	3 x 4	10.5	1800	..	B-HM	H-E	....	....	21	18	19	270
NXB	B	S-P	4	2	3¼ x 4	12.5	1800	..	B-HM	H-E	....	....	21	18	19	270
ZXA	B	S-P	4	4	2⅞ x 3	14.7	2500	..	B-HM	H-E	....	....	24	17	17	179

(Specifications continued on next page)

Hercules *(Continued from preceding page)*

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP,	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ZXB	B	S-P	4	4	2⅝ x 3	15.7	2500	..	B-HM	H-E	....	....	24	17	17	179
IXA	B	S-P	4	4	3 x 4	22.1	1800	..	B-HM	H-E	....	....	27	18	20	285
IXB	B	S-P	4	4	3¼ x 4	26.4	1800	..	B-HM	H-E	....	....	27	18	20	293
IXLB	B	S-P	4	4	3¼ x 4¼	28	1800	..	B-HM	H-E	....	....	27	18	20	293
JX4E	B	S-P	4	4	3½ x 4½	34.8	1800	..	B-HM	H-E	....	....	32	21	25	470
JX4C	B	S-P	4	4	3⅝ x 4¼	40.2	1800	..	B-HM	H-E	....	....	32	21	25	470
JX4D	B	S-P	4	4	4 x 4¼	45.5	1800	..	B-HM	H-E	....	....	32	21	25	470
QXA	B	S-P	4	6	3¼ x 4½	37.8	1800	..	B-HM	H-E	....	....	36	18	21	440
QXB	B	S-P	4	6	3¼ x 4½	40.8	1800	..	B-HM	H-E	....	....	36	18	21	440
QXC	B	S-P	4	6	3½ x 4½	46	1800	..	B-HM	H-E	....	....	36	18	21	440
QXD	B	S-P	4	6	3⅝ x 4½	48.5	1800	..	B-HM	H-E	....	....	36	18	21	440
QXLD	B	S-P	4	6	3⅞ x 4½	54.5	1800	..	B-HM	H-E	....	....	36	18	21	440
JXB	B	S-P	4	6	3⅝ x 4¼	55.2	1800	..	B-HM	H-E	....	....	39	19	25	605
JXC	B	S-P	4	6	3¾ x 4¼	60.4	1800	..	B-HM	H-E	....	....	39	19	25	605
JXD	B	S-P	4	6	4 x 4¼	69.7	1800	..	B-HM	H-E	....	....	39	19	25	605
JXLD	B	S-P	4	6	4 x 4½	77.6	1800	..	B-HM	H-E	....	....	39	19	25	630
WXC3	B	S-P	4	6	4¼ x 4½	86	1800	..	B-HM	H-E-A	....	....	43	24	29	820
WXLC	B	S-P	4	6	4 x 4¾	79	1800	..	B-HM	H-E-A	....	....	43	27	29	811
WXLC3	B	S-P	4	6	4¼ x 4¾	89	1800	..	B-HM	H-E-A	....	....	43	27	29	825
TDXB	B	S-P	4	6	4½ x 5¼	106	1800	..	B-HM	H-E-A	....	....	48	28	35	1220
TDXC	B	S-P	4	6	4½ x 5¼	111	1800	..	B-HM	H-E-A	....	....	48	28	35	1220
RXB	B	S-P	4	6	4½ x 5¼	98.5	1800	..	B-HM	H-E-A	....	....	47	27	33	1000
RXC & LC	B	S-P	4	6	4½ x 5¼	104–110.5	1800	..	B-HM	H-E-A	....	....	47	27	33	1010
RXLD & H	B	S-P	4	6	4¾ x 5¼	116.5–125	1800	..	B-HM	H-E-A	....	....	47	26	36	1195
HXB	B	S-P	4	6	5 x 6	120	1600	..	B-HM	H-E-A	....	....	56	30	41	1810
HXC	B	S-P	4	6	5¼ x 6	132.5	1600	..	B-HM	H-E-A	....	....	56	30	41	1810
HXD	B	S-P	4	6	5½ x 6	155	1600	..	B-HM	H-E-A	....	....	56	30	41	1830
HXE	B	S-P	4	6	5¾ x 6	176	1600	..	B-HM	H-E-A	....	....	56	30	41	1830

Engines have turbulence-chamber combustion system. Lengths measured from bellhousing face to front support. Heights measured from crankshaft to top of cylinder head cover. Weights are approximate and include engine with fuel handling equipment only and no other accessories not forming an integral part of the engine. Various mounting arrangements, flywheel housings, oil pans, manifolds, starting motor and generator locations are available to meet specific applications requirements.

Ingersoll-Rand Company
11 Broadway, New York 4, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
T	A	M-S-P	4	6	7 x 8½	220	1000	O	....	A-E	....	*	86	45	69	....
T	A	M-S-P	4	8	7 x 8½	290	1000	O	....	A-E	....	*	108	45	69	....
TS	A	M-S-P	4	6	7 x 8½	350	1000	O	....	A-E	T	*	86	48	69	....
TS	A	M-S-P	4	8	7 x 8½	465	1000	O	....	A-E	T	*	108	48	69	....
S	A	M-S-P	4	5	10½ x 12	376	750	O	....	A-E	....	*	116	49	85	....
S	A	M-S-P	4	6	10½ x 12	450	750	O	....	A-E	....	*	132	49	85	....
S	A	M-S-P	4	7	10½ x 12	525	750	O	....	A-E	....	*	149	49	85	....
S	A	M-S-P	4	8	10½ x 12	600	750	O	....	A-E	....	*	165	49	85	....
SS	A	M-S-P	4	5	10½ x 12	580	750	O	....	A-E	T	*	116	53	85	....
SS	A	M-S-P	4	6	10½ x 12	750	750	O	....	A-E	T	*	132	53	85	....
SS	A	M-S-P	4	7	10½ x 12	825	750	O	....	A-E	T	*	149	53	85	....
SS	A	M-S-P	4	8	10½ x 12	1000	750	O	....	A-E	T	*	165	53	85	....

* Reverse & Reduction Gear—make not known.

International Harvester Co.
180 No. Michigan Avenue, Chicago 1, Illinois

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
UD-264	A	S-P	4	4	4 x 5¼	55	1800	O	....	E-G	....	....	63	25	47	1765
UD-350	A	S-P	4	4	4½ x 5½	75	1800	O	....	E-G	....	....	66	28	54	2110
UD-14A	A	S-P	4	4	4¾ x 6½	76	1400	O	....	E-G	....	....	78	33	57	2835
UD-525	A	S-P	4	6	4½ x 5½	115	1800	O	....	E-G	....	....	89	36	57	3150
UD-18A	A	S-P	4	6	4¾ x 6½	125	1600	O	....	E-G	....	....	96	36	60	4165
UD-1091	A	S-P	4	6	5¾ x 7	190	1400	O	....	E-G	....	....	108	44	72	5840
U-1	B	S-P	4	4	2⅝ x 2¾	16.5	2500	..	HM	H-E	....	....	44	23	33	450
U-2A	B	S-P	4	4	3 x 4	24	1800	..	B	H-E	....	....	52	23	40	750
U-164	B	S-P	4	4	3½ x 4¼	36.5	1800	..	B	H-E	....	....	55	24	41	1015
U-264	B	S-P	4	4	4 x 5¼	55	1800	..	B	H-E	....	....	63	29	50	1500
U-9	B	S-P	4	4	4.4 x 5.5	55	1500	..	B	H-E	....	....	68	31	51	1825
U-220	B	S-P	4	6	3⅛ x 3 11/16	62	2400	..	B	H-E	....	....	65	28	50	1180
U-240	B	S-P	4	6	3⅛ x 4.018	64	2400	..	B	H-E	....	....	65	28	50	1195
U-282	B	S-P	4	6	3 11/16 x 4⅛	75.5	2400	..	B	H-E	....	....	65	28	50	1305
U-372	B	S-P	4	6	4⅛ x 4⅛	91.5	2200	..	B	H-E	....	....	71	28	57	1724
U-406	B	S-P	4	6	4⅛ x 4½	98	2200	..	B	H-E	....	....	73	28	57	1763
U-450	B	S-P	4	6	4⅛ x 5	110	2200	..	B	H-E	....	....	73	28	57	1855
U-1091	B	S-P	4	6	5¾ x 7	200	1600	..	B	E	....	....	108	44	64	5450

Diesel engines: Horsepower shown is for complete power unit with radiator & fan as obtained at sea level with regular production injection pump setting. Dimensions include radiator and direct-drive rear power take-off.

Kahlenberg Brothers Company
1707-12th Street
Two Rivers, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AD	A	M-S	2	2	8½ x 9	30–36	400	O	....	A	....	O	...	...	...	5450
AT	A	M-S	2	3	8½ x 9	45–54	400	O	....	A	....	O-D	...	...	...	6500
AF	A	M-S	2	4	8½ x 9	60–70	400	O	....	A	....	O-D	...	...	...	8200
BD	A	M-S	2	2	10 x 10½	50–60	375	O	....	A	....	O	...	...	...	7800
BT	A	M-S	2	3	10 x 10½	90	375	O	....	A	....	†D	...	...	...	9700
BF	A	M-S	2	4	10 x 10½	120	375	O	....	A	....	†D	...	...	...	11980
B5	A	M-S	2	5	10 x 10½	150	375	O	....	A	....	†D	...	...	...	15650
B6	A	M-S	2	6	10 x 10½	180	375	O	....	A	....	D	...	...	...	17050
CT	A	M-S	2	3	12½ x 14	150	325	O	....	A	....	†D	...	...	...	21780
CF	A	M-S	2	4	12½ x 14	200	325	O	....	A	....	†D	...	...	...	23900
C5	A	M-S	2	5	12½ x 14	250	325	O	....	A	....	D	...	...	...	29000
C6	A	M-S	2	6	12½ x 14	300	325	O	....	A	....	D	...	...	...	34000

† *Own reverse gear optional.*

The Lathrop Engine Company
Mystic, Conn.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D-60	A	M	4	4	5½ x 7	60	900	B	....	E	....	O	75	29	31	3000
D-120	A	M	4	6	5½ x 7	120	1100	B	....	E	....	S	108	31	31	4100
DFXH	A	M	4	6	5¾ x 6	187	1600	B	....	E	....	C	88	38	36	4230
DNX-V8DTS	A	M	4	8	6¾ x 6	355	1600	B	....	E	M	C	98	45	51	7740
DIX-4E	A	M	4	4	3⅞ x 4	58	2800	B	....	E	....	P	54	23	23	950
DIX-4ES	A	M	4	4	3⅞ x 4	74	2800	B	....	E	M	P	55	24	21	1050
DIX-6E	A	M	4	6	3⅞ x 4	88	2800	B	....	E	....	P	66	24	23	1440
DIX-6ES	A	M	4	6	3⅞ x 4	113	2800	B	....	E	M	P	66	23	23	1550

LeRoi Division
Westinghouse Air Brake Co.
1706 South 68th Street, Milwaukee 14, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D201	B	S-P	4	4	4 x 4	32	1200	..	HM*	E-H	....	....	54	27	54	851†
D226	B	S-P	4	4	4 x 4½	38	1200	..	HM*	E-H	....	....	57	24	36	1000†
A288	B	S	4	1	7¼ x 7	24.7	720	..	HM*	E-H	....	....	64	47	54	2300
A114	B	S	4	1	5¼ x 5¼	13.6	1000	..	HM*	E-H	....	....	47	49	51	1530
H540	B	S-P	4	8	4½ x 4¼	147	2000	..	HM*	E	....	....	81	40	64	2000†
H844	B	S-P	4	8	5¼ x 4¼	210	2000	..	HM*	E	....	....	88	50	74	2740†
F1500	B	S-P	4	6	6¾ x 7	190	1000	..	HM**	G-A	....	....	115	50	84	5800
H2000	B	S	4	8	6¾ x 7	252	1000	..	HM**	G-A	....	....	88	52	72	5850
L3000	B	S	4	12	6¾ x 7	380	1000	..	HM**	G-A	....	....	111	60	84	8850
L3460	B	S	4	12	7¼ x 7	560	1200	..	HM**	G-A	....	....	164	66	95	10400
L4000	B	S	4	12	7.54 x 7.5	635	1200	..	HM**	G-A	....	....	164	66	95	10400

** Distributor available.* *** LM available.* *† Lighter automotive units available. Weights are given for stationary units (dry).*

Lufkin Foundry & Machine Co.,
Lufkin, Texas

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
H833	B	S	2	2	5½ x 7	20–30	425–650	..	HM	E-A	....	....	59	58	52	2900
H795	B	S	2	2	7½ x 9	45–65	400–600	..	HM	E-A	....	....	76	66	90	4250

Mack Motor Truck Corporation
350 Fifth Ave., New York 1, N.Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
END673	A	P	4	6	4⅞ x 6	170	2100	B	....	E-A	....	....	51	27	45	1917*

** Bare engine.*

Minneapolis-Moline Company
Minneapolis 1, Minnesota

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
206A-4	B	S-P	4	4	3⅝ x 5	32	1500	..	B-H-M	E	....	T-C*	38	21	36	900
283-4	D	S-P	4	4	4¼ x 5	44.8	1300	B	B-H-M	E	....	T-C*	46	25	46	1400
403-4	B	S-P	4	4	4½ x 6	57.6	1200	..	B-H-M	E	....	T-C*	46	25	46	1590
425-6	D	S-P	4	6	4¼ x 5	66.4	1400	B	B-H-M	E	....	T-C*	60	25	48	2100
605-6	D	S-P	4	6	4½ x 6	84	1200	B	B-H-M	E	....	T-C*	60	29	54	2500
800-6	B	S-P	4	6	5⅛ x 6	118	1300	..	B-H-M	E	....	T-C*	60	29	54	3125
1210-12	B	S-P	4	12	4½ x 6	160	1200	..	B-H-M	E	....	T-C*	112	49	72	5800
1600-12	B	S	4	12	5⅛ x 6	233	1300	..	B-H-M	E	....	T-C*	112	49	72	6800

*Note: Type "B" engine includes gasoline, natural gas, LPG and tractor fuel. *Optional.*

Murphy Diesel Company
5317 West Burnham Street, Milwaukee, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ME4	A	M-P	4	4	5¾ x 6½	90	1200	O	....	E	....	....	....	....	....	....
11	A	M-P	4	4	5¾ x 6½	100–110	1200–1400	O	....	E	....	....	70	43	66	3800
12	A	M-P	4	4	6 x 6⅔	110–120	1200–1400	O	....	E	....	T	70	43	66	3800
111	A	M-P	4	4	5¾ x 6⅔	115–125	1200–1400	O	....	E	*	T	70	43	66	3900
112	A	M-P	4	4	6 x 6⅔	125–135	1200–1400	O	....	E	*	T	70	43	66	3900
20	C	M-P	4	6	5¼ x 6½	135–145	1200–1400	O	....	E	....	S-T	93	43	66	4700
120	A	M-P	4	6	5½ x 6½	145–157	1200–1400	O	....	E	*	S-T	93	43	66	4800
21	C	M-P	4	6	5¾ x 6⅔	150–162	1200–1400	O	....	E	....	S-T	93	43	66	4700
22	C	M-P	4	6	6 x 6⅔	165–178	1200–1400	O	....	E	....	T	93	43	66	4700
121	A	M-P	4	6	5¾ x 6⅔	170–184	1200–1400	O	....	E	*	T	93	43	66	4800
122	A	M-P	4	6	6 x 6⅔	190–205	1200–1400	O	....	E	*	T	93	43	66	4800
24	C	M-P	4	6	6⅛ x 6⅔	185–200	1200–1400	O	....	E	....	T	93	43	66	4700
324	A	M-P	4	6	6¾ x 6½	210–225	1200–1400	O	....	E	*	T	93	43	66	4800

** Tubo-supercharging manifold. All engines have open-type combustion chambers and unit injectors. Marine engines carry different model numbers, weights and dimensions.*

The National Supply Co., Engine Division
Springfield 99, Ohio
Superior Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6G-510	B	S-P	4	6	8½ x 9	190–325	600–1000	..	HM	A-E-G	....	....	...	...	...	10000
40-6	C	M-S-P	4	6	8½ x 10½	215–325	600–900	D-B	....	A	....	S-T	...	...	...	14000
40-8	C	M-S-P	4	8	8½ x 10½	290–435	600–900	D-B	....	A	....	S-T	...	...	...	17000
40X-6	C	M-S-P	4	6	8½ x 10½	325–490	600–900	D-B	....	A	T	S-T	...	...	...	15500
40X-8	C	M-S-P	4	8	8½ x 10½	435–700	600–900	D-B	....	A	T	S-T	...	...	...	18500
44-G	B	S-P	4	6	9 x 10½	245–365	600–900	..	HM	A	....	....	...	...	...	14000
6G-825	B	S-P	4	6	10 x 10½	300–450	600–900	..	HM	A	....	....	...	...	...	14500
8G-825	B	S-P	4	8	10 x 10½	400–600	600–900	..	HM	A	....	....	...	...	...	18500
60-6	C	M-S	4	6	12 x 15	410–530	400–514	B	....	A	....	....	...	...	...	39500
60-8	C	M-S	4	8	12 x 15	550–615	400–450	B	....	A	....	....	...	...	...	49000
60X-6	C	M-S	4	6	12 x 15	615–795	400–514	S	....	A	T	....	...	...	...	41500
60X-8	C	M-S	4	8	12 x 15	825–925	400–450	S	....	A	T	....	...	...	...	51000
65-6	C	M-S	4	6	12¾ x 15	580–700	500–600	S	....	A	....	....	...	...	...	44000
65-8	C	M-S	4	8	12¾ x 15	775–930	500–600	S	....	A	....	....	...	...	...	52000
65X-6	C	M-S	4	6	12¾ x 15	940–1325	500–600	S	....	A	T	....	...	...	...	46000
65X-8	C	M-S	4	8	12¾ x 15	1255–1765	500–600	S	....	A	T	....	...	...	...	55000
80-6	D	M-S	4	6	14½ x 20	600–750	300–375	S	P	A	....	....	...	...	...	68000
80-8	D	M-S	4	8	14½ x 20	800–1000	300–375	S	P	A	....	....	...	...	...	85000
80X-6	D	M-S	4	6	14½ x 20	900–1125	300–375	S	P	A	T	....	...	...	...	71500
80X-8	D	M-S	4	8	14½ x 20	1200–1500	300–375	S	P	A	T	....	...	...	...	90000

Atlas Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
35-4	A	M-S	4	4	6½ x 8¼	100–110	1000	B	P	A-E	....	S	...	...	...	6000
35-6	A	M-S	4	6	6½ x 8¼	150–195	1200	B	P	A-E	....	S	...	...	...	8000
35X-6	A	M-S	4	6	6½ x 8¼	225–300	1200	B	P	A-E	T	S-T	...	...	...	8500
45-4	A	M-S-P	4	4	9 x 10½	160–190	600–750	B-S	....	A	....	C-W	...	...	...	13500
45-5	A	M-S-P	4	5	9 x 10½	200–240	600–750	B-S	....	A	....	C-W	...	...	...	14800
45-6	C	M-S-P	4	6	9 x 10½	240–300	600–750	B-S	....	A	....	C-W	...	...	...	17400
45-8	C	M-S-P	4	8	9 x 10½	320–400	600–750	B-S	....	A	....	C-W	...	...	...	21600
45X-6	C	M-S-P	4	6	9 x 10½	360–450	600–750	B-S	....	A	T	C-W	...	...	...	18400
45X-8	C	M-S-P	4	8	9 x 10½	480–600	360–750	B-S	....	A	T	C-W	...	...	...	22700
38	A	M-S	4	4	8 x 10½	85	450	*	....	A	....	....	...	...	...	11500
48	A	M-S	4	4	9 x 10½	110	325	*	....	A	....	....	...	...	...	15000
55	A	M-S	4	6	10¼ x 13	250	350	*	....	A	....	....	...	...	...	28000
58	A	M-S	4	6	11½ x 15	350	360	*	....	A	....	....	...	...	...	43000
75-6	A	M-S	4	6	13 x 16	425	333	*	....	A	....	....	...	...	...	48000
75X-6	A	M-S	4	6	13 x 16	600	333	*	....	A	T	....	...	...	...	51000
76-6	A	M-S	4	6	13 x 16	500	360–400	B	....	A	....	....	...	...	...	50000
76X-6	A	M-S	4	6	13 x 16	750	360–400	B	....	A	T	....	...	...	...	53000
85-6	A	M-S	4	6	15 x 19	650	325	*	....	A	....	....	...	...	...	80000
85X-6	A	M-S	4	6	15 x 19	1000	325	*	....	A	T	....	...	...	...	83000

* Common Rail.

Lister Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
3½-1	A	S-P	4	1	3¾ x 5½	3½	650	B	....	H	....	....	36	24	40	750
6-1	A	S-P	4	1	4½ x 5½	6	650	B	....	H	....	....	36	24	40	760
12-2	A	S-P	4	2	4½ x 5½	12	650	B	....	H	....	....	50	24	40	1130
21-2	A	M-S	4	2	4½ x 5½	21	1200	B	....	H-E-A	....	....	48	25	41	1625
30-3	A	M-S	4	3	4½ x 5½	30	1200	B	....	H-E-A	....	....	58	25	41	2040
40-4	A	M-S	4	4	4½ x 5½	40	1200	B	....	H-E-A	....	....	67	25	41	2275
61-6	A	M-S	4	6	4½ x 5½	63	1200	B	....	A-E	....	....	75	32	44	3000
FR1	A	M-S-P	4	1	3¾ x 4½	9	1800	B	....	H-E	....	S	27	23	36	750
FR2	A	M-S-P	4	2	3¾ x 4½	18	1800	B	....	H-E	....	S	32	23	36	970
FR3	A	M-S-P	4	3	3¾ x 4½	27	1800	B	....	H-E	....	S	37	23	36	1100
FR4	A	M-S-P	4	4	3¾ x 4½	36	1800	B	....	H-E	....	S	44	23	36	1270
FR6	A	M-S-P	4	6	3¾ x 4½	54	1800	B	....	H-E	....	S	54	23	36	1590

Armstrong-Siddeley Engines

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AS-1	A	M-S-P	4	1	4¼ x 4¼	11	1800	B	....	H-E	....	....	27	24	34	510
AS-2	A	M-S-P	4	22	4¼ x 4¼	22	1800	B	....	H-E	....	....	35	24	37	700

Nordberg Manufacturing Company
Milwaukee, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
4FS-1	A	S	4	1	4½ x 5¼	10–15	1200–1800	B	....	E-H	....	....	...	...	...	.....
4FG-1	B	S	4	1	4½ x 5¼	8–18	800–1800	..	HM	E-H	....	....	...	...	...	.....
4FS-2	A	S	4	2	4½ x 5¼	20–30	1200–1800	B	....	E-H	....	....	...	...	...	.....
4FG-2	B	S	4	2	4½ x 5¼	16–36	800–1800	..	HM	E-H	....	....	...	...	...	.....
4FS-3	A	S	4	3	4½ x 5¼	30–45	1200–1800	B	....	E-H	....	....	...	...	...	.....
4FG-3	B	S	4	3	4½ x 5¼	24–54	800–1800	..	HM	E-H	....	....	...	...	...	.....
FS-95-SC	D	S	4	5	9 x 11½	330–420	600–750	S	LM	A	T	....	...	...	...	.....
FS-96-SC	D	M-S	4	6	9 x 11½	400–665	600–1000	S	LM	A	T	D	...	...	...	.....
FS-97-SC	D	S	4	7	9 x 11½	465–580	600–750	S	LM	A	T	....	...	...	...	.....
FS-98-SC	D	M-S	4	8	9 x 11½	530–885	600–1000	S	LM	A	T	D	...	...	...	.....
FS-96-HSC*	D	M-S	4	6	9 x 11½	535–1050	600–1000	S	LM	A	T	D	...	...	...	.....
FS-97-HSC*	D	S	4	7	9 x 11½	620–920	600–750	S	LM	A	T	....	...	...	...	.....
FS-98-HSC*	D	M-S	4	8	9 x 11½	710–1480	600–1000	S	LM	A	T	D	...	...	...	.....
FS-136	D	M-S	4	6	13 x 16½	600–800	450–600	S	P	A	....	D	...	...	...	.....
FS-137	D	S	4	7	13 x 16½	700–800	450–514	S	P	A	....	....	...	...	...	.....
FS-138	D	M-S	4	8	13 x 16½	800–1065	450–600	S	P	A	....	D	...	...	...	.....
FS-135-SC	D	S	4	5	13 x 16½	750–850	450–514	S	P	A	T	....	...	...	...	.....

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
FS-136-SC	D	M-S	4	6	13 x 16½	900–1200	450–600	S	P	A	T	D	...	...	...	.....
FS-137-SC	D	S	4	7	13 x 16½	1050–1200	450–514	S	P	A	T	....	...	...	...	.....
FS-138-SC	D	M-S	4	8	13 x 16½	1200–1600	450–600	S	P	A	T	D	...	...	...	.....
FS-135-HSC*	D	S	4	5	13 x 16½	1000–1350	450–514	S	P	A	T	....	...	...	...	.....
FS-136-HSC*	D	M-S	4	6	13 x 16½	1200–1900	450–600	S	P	A	T	D	...	...	...	.....
FS-137-HSC*	D	M-S	4	7	13 x 16½	1400–1900	450–514	S	P	A	T	D	...	...	...	.....
FS-138-HSC*	D	M-S	4	8	13 x 16½	1600–2500	450–600	S	P	A	T	D	...	...	...	.....
FS-1310-HSC*	D	M-S	4	10	13 x 16½	2000–2700	450–514	S	P	A	T	D	...	...	...	.....
FS-1312-HSC*	D	M-S	4	12	13 x 16½	2400–3800	450–600	S	P	A	T	D	...	...	...	.....
FS-1316-HSC*	D	M-S	4	16	13 x 16½	3200–5000	450–600	S	P	A	T	D	...	...	...	.....
FS-136-SC	D	M-S	4	6	13 x 20	870–1090	360–450	S	P	A	T	D	...	...	...	.....
FS-137-SC	D	M-S	4	7	13 x 20	1020–1130	360–400	S	P	A	T	D	...	...	...	.....
FS-138-SC	D	M-S	4	8	13 x 20	1165–1450	360–450	S	P	A	T	D	...	...	...	.....
FS-136-HSC*	D	M-S	4	6	13 x 20	1160–1720	360–450	S	P	A	T	D	...	...	...	.....
FS-137-HSC*	D	M-S	4	7	13 x 20	1360–1800	360–400	S	P	A	T	D	...	...	...	.....
FS-138-HSC*	D	M-S	4	8	13 x 20	1555–2300	360–450	S	P	A	T	D	...	...	...	.....
RTS**-1412	D	M-S	2	12	14 x 16	2125	400	B	P	A	....	....	...	...	...	.....
TS-215	C	M-S	2	5	21½ x 31	2550–2925	240–257	B	....	A	....	D	...	...	...	.....
TS-216	C	M-S	2	6	21½ x 31	3050–3500	240–257	B	....	A	....	D	...	...	...	.....
TS-217	C	M-S	2	7	21½ x 31	3575–4100	240–257	B	....	A	....	D	...	...	...	.....
TS-218	C	M-S	2	8	21½ x 31	4075–4675	240–257	B	....	A	....	D	...	...	...	.....
TS-219	C	M-S	2	9	21½ x 31	4600–5275	240–257	B	....	A	....	D	...	...	...	.....
TS-2110	C	M-S	2	10	21½ x 31	5100–5850	240–257	B	....	A	....	D	...	...	...	.....
TS-2112	C	M-S	2	12	21½ x 31	6150–7025	240–257	B	....	A	....	D	...	...	...	.....
TS-295	C	M-S	2	5	29 x 40	4500–5300	180–200	B	....	A	....	D	...	...	...	.....
TS-296	C	M-S	2	6	29 x 40	5400–6400	180–200	B	....	A	....	D	...	...	...	.....
TS-297	C	M-S	2	7	29 x 40	6300–7500	180–200	B	....	A	....	D	...	...	...	.....
TS-298	C	M-S	2	8	29 x 40	7200–8500	180–200	B	....	A	....	D	...	...	...	.....
TS-299	C	M-S	2	9	29 x 40	8100–9600	180–200	B	....	A	....	D	...	...	...	.....
TS-2910	C	M-S	2	10	29 x 40	9000–10600	180–200	B	....	A	....	D	...	...	...	.....
TS-2912	C	M-S	2	12	29 x 40	10800–12800	180–200	B	....	A	....	D	...	...	...	.....

* Supairthermal execution. ** Radial engine. Engines are designed to operate continuously at ratings shown and are good for 10 per cent overload for 2 hr in any 24 hr period.

Rathbun-Jones Engineering Company
Toledo, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
18	C	S	4	3	11 x 18	220	450	O	....	A	....	....	158	70	106	26000
18	C	S	4	4	11 x 18	290	450	O	....	A	....	....	177	70	106	31500
18	C	S	4	5	11 x 18	364	450	O	....	A	....	....	196	70	106	36300
18	C	M-S	4	6	11 x 18	435	450	O	....	A	....	D	215	70	106	41200
18	C	M-S	4	7	11 x 18	510	450	O	....	A	....	D	238	70	106	46000
18	C	M-S	4	8	11 x 18	580	450	O	....	A	....	D	258	70	106	51000
22	C	S	4	3	15½ x 22	388	327	O	....	A	....	....	175	80	126	41500
22	C	S	4	4	15½ x 22	518	327	O	....	A	....	....	197	80	126	50000
22	C	S	4	5	15½ x 22	650	327	O	....	A	....	....	225	80	126	58500
22	C	M-S	4	6	15½ x 22	775	327	O	....	A	....	D	247	80	126	68000
22	C	M-S	4	7	15½ x 22	910	327	O	....	A	....	D	271	80	126	75500
22	C	M-S	4	8	15½ x 22	1085	327	O	....	A	....	D	298	80	126	85000
24	C	S	4	3	18¼ x 24	540	300	O	....	A	....	....	200	85	140	60000
24	C	S	4	4	18¼ x 24	720	300	O	....	A	....	....	231	85	140	74000
24	C	S	4	5	18¼ x 24	900	300	O	....	A	....	....	258	85	140	87000
24	C	M-S	4	6	18¼ x 24	1080	300	O	....	A	....	D	294	85	140	98000
24	C	M-S	4	7	18¼ x 24	1260	300	O	....	A	....	D	321	85	140	110000
24	C	M-S	4	8	18¼ x 24	1440	300	O	....	A	....	D	348	85	140	120000
28	C	S	4	5	19½ x 28	1025	257	O	....	A	....	....	332	104	171	140000
28	C	M-S	4	6	19½ x 28	1230	257	O	....	A	....	D	339	104	171	164000
28	C	M-S	4	7	19½ x 28	1435	257	O	....	A	....	D	380	104	171	187000
28	C	M-S	4	8	19½ x 28	1640	257	O	....	A	....	D	409	104	171	212000
28	C	S	4	10	19½ x 28	2050	257	O	....	A	....	....	460	104	171	230000
28	C	S	4	12	19½ x 28	2460	257	O	....	A	....	....	528	104	171	260000

Engines have Price turbulence chamber combustion system and Rathbun distributor type fuel injection system. Lengths listed are approximate for stationary engines and include generator, exciter drive and outboard bearing. Widths include operating platforms. Marine lengths, including thrust bearing, are considerably shorter. Weights are for stationary units.

R. H. Sheppard Company, Inc.
Hanover, Pennsylvania

Mode	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
9	A	S	4	1	3½ x 4	4	1800	O	....	E	....	....	29	23	36	495
7	A	S	4	1	4 x 5	10	1800	O	....	E	....	....	37	31	46	1090
7D	A	S	4	1	4¼ x 5	11	1800	O	....	E	....	....	37	31	46	1090
17	A	M-S	4	2	3½ x 4	13.5	1800	O	....	E	....	†	33	22	31	550
18	A	M-S-P	4	2	4 x 5	20	1800	O	....	E	....	†	43	24	49	1365
18D	A	M-S-P	4	2	4¼ x 5	22	1800	O	....	E	....	†	43	24	49	1365
6A-1	A	M-S-P	4	3	4 x 5	30	1800	O	....	E	....	†	55	26	51	1662
6D	A	M-S-P	4	3	4¼ x 5	34	1800	O	....	E	....	†	55	26	51	1662
16	A	M-S-P	4	4	4½ x 5	51.4	1800	O	....	E	....	†	65	22	46	1725
12	A	M-S-P	4	6	4 x 5	61	1800	O	....	E	....	†	70	24	52	2100
12D	A	M-S-P	4	6	4¼ x 5	67	1800	O	....	E	....	†	70	24	52	2100

† *Reverse gear optional. Weights & dimensions are for "S" & "P" units.*

Sterling Engine Company
Buffalo, New York

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AB-6	A	M-S	4	6	4½ x 5¼	72–110	1400–1800	B	....	E	....	S	58	30	53	3150
DB-6	A	M-S	4	6	5½ x 7	114–170	1200–1500	B	....	E	....	S	60	36	60	5200
DB-8	A	M-S	4	8	5½ x 7	152–280	1200–1500	B	....	E	....	S	75	36	60	6850
VD-6	A	M-S	4	6	8 x 9	420	1200	B-S	....	A-E	....	S-T	95	40	64	8500
VD-6-S	A	M-S	4	6	8 x 9	750	1200	B	....	A-E	T	S	115	40	64	9160
VD-8-S	A	S	4	8	8 x 9	1000	1200	B	....	A-E	T	....	136	40	64	12450
LC-6	B	S	4	6	5¼ x 6	72–110	800–2000	..	B	E	....	....	57	33	42	2200
TC-6	B	S	4	6	8 x 9	260–450	700–1200	..	B	A-E	....	....	101	45	64	6900
TC-8	B	S	4	8	8 x 9	365–600	700–1200	..	B	A-E	....	....	122	45	64	9000

Weights and dimensions are given for "S" units. Horsepower listings indicate continuous and intermittent ratings.

Sun Shipbuilding and Dry Dock Co.
Chester, Pennsylvania

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
510-LB-3	..	M	2	3	20⅛ x 44½ +33⅛	1500	90	O	....	A	....	D	444	132	336	322000
540-L-4	..	M	2	4	21¼ x 42½ +42½	2500	90	O	....	A	....	D	576	132	362*	470000
580-L-4	..	M	2	4	22⅛ x 45⅝ +45⅝	2800	80	O	....	A	....	D	612	134	389	580000
600-L-4	..	M	2	4	23⅝ x 45⅝ +45⅝	3000	80	O	....	A	....	D	624	134	389	625000
600-LB-4	..	M	2	4	23⅝ x 45⅝ +33⅛	2700	100	O	....	A	....	D	624	134	385*	600000
640-LB-6	..	M	2	6	25⅛ x 45⅝ +33⅛	5600	100	O	....	A	....	D	816	134	427*	930000
26-LB-4	..	M	2	4	26 x 46 +33	3600	115	O	....	A	....	D	624	134	401*	655000
31-LB-4	..	M	2	4	31 x 50 +36	4800	90	O	....	A	....	D	729	152	433*	1015000
31-LB-5	..	M	2	5	31 x 50 +36	7200	100	O	....	A	....	D	808	152	407	1166000
32-LB-4	..	M	2	4	32 x 55 +40	6000	94	O	....	A	....	D	736	152	427	1052000
32-LB-5	..	M	2	5	32 x 55 +40	7500	94	O	....	A	....	D	862	152	490*	1342000
21-LB-6†	..	M	2	6	21 x 35 +25	4500	180	O	....	A	....	D	602	127	292	450000
.....	..	S	2	4	21 x 35 +25	3000	200	..	....	.....	....	....	540	127	315*	366000
.....	..	S	2	5	21 x 35 +25	3800	200	..	....	.....	....	....	629	127	325*	458000
.....	..	S	2	6	21 x 35 +25	4500	200	..	....	.....	....	....	718	127	333*	550000
.....	..	S	2	4	26 x 46 +33	4500	150	..	....	.....	....	....	624	134	401*	655000
.....	..	S	2	5	26 x 46 +33	6000	150	..	....	.....	....	....	757	134	399*	820000
.....	..	S	2	6	26 x 46 +33	7500	150	..	....	.....	....	....	863	134	411*	985000
.....	..	S	2	4	32 x 55 +40	9000	138	..	....	.....	....	....	736	152	468*	1145000
.....	..	S	2	5	32 x 55 +40	11200	138	..	....	.....	....	....	862	152	490*	1342000
.....	..	S	2	6	32 x 55 +40	13500	138	..	....	.....	....	....	1092	152	444*	1700000

*Engines are of the opposed-piston type. † Drives through reduction gear (Ratio 2.092 to 1) Maximum heights shown. * Height to top of scavenging air pump. Other figures show cylinder height.*

Union Diesel Engine Co.,
Oakland, Calif.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
GA6	D	M-S	4	6	8½ x 11	175–225	475–600	O	LM	A	T	D	144	34	68	14000
GA6S	D	M-S	4	6	8½ x 11	260–330	475–600	O	LM	A	T	D	146	34	68	15000
L6	D	M-S	4	6	10 x 14	230–340	350–514	O	LM	A	T	D	175	42	85	23500
L6S	D	M-S	4	6	10 x 14	340–500	350–514	O	LM	A	T	D	178	42	85	24500
P6	D	M-S	4	6	12 x 15	410–525	400–514	O	LM	A	T	D	194	46	98	36500
P6S	D	M-S	4	6	12 x 15	600–700	400–514	O	LM	A	T	D	194	46	98	38000
V6	D	M-S	4	6	14 x 19	560–700	325–400	O	LM	A	T	D	242	57	114	58000
V6S	D	M-S	4	6	14 x 19	740–1000	325–400	O	LM	A	T	D	242	57	114	60000
Z6	D	M-S	4	6	16 x 20¼	600–750	240–300	O	LM	A	T	D	275	62	125	87500
Z6S	D	M-S	4	6	16 x 20¼	900–1125	240–300	O	LM	A	T	D	285	62	125	90000
GA8	D	M-S	4	8	8½ x 11	235–300	450–600	O	LM	A	T	D	178	34	68	18000
GA8S	D	M-S	4	8	8½ x 11	345–440	450–600	O	LM	A	T	D	180	34	68	19000
L8	D	M-S	4	8	10 x 14	300–450	350–514	O	LM	A	T	D	214	42	85	32000
L8S	D	M-S	4	8	10 x 14	420–560	350–514	O	LM	A	T	D	217	42	85	33500
P8	D	M-S	4	8	12 x 15	550–700	400–514	O	LM	A	T	D	235	46	98	46000
P8S	D	M-S	4	8	12 x 15	800–1000	400–514	O	LM	A	T	D	239	46	98	48000
V8	D	M-S	4	8	14 x 19	750–925	325–400	O	LM	A	T	D	292	57	114	74000
V8S	D	M-S	4	8	14 x 19	1125–1400	325–400	O	LM	A	T	D	296	57	114	76000
Z8	D	M-S	4	8	16 x 20¼	800–1000	240–300	O	LM	A	T	D	347	62	125	112000
Z8S	D	M-S	4	8	16 x 20¼	1200–1500	240–300	O	LM	A	T	D	350	62	125	116000

Waukesha Motor Company
Waukesha, Wisconsin

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
ICK	B	S-P	4	4	2½ x 3¼	12*	2000	..	B-HM	H-E	....	....	22	18	21	195
FC	B	S-P	4	4	3¼ x 4	26*	1800	..	B-HM	H-E	....	....	28	19	21	290
180GLB	B	S-P	4	4	3½ x 3¾	32*	2000	..	B-HM	H-E	....	....	31	19	28	450
180DLC	A	S-P	4	4	3½ x 3¾	31*	2000	B	....	H-E	....	....	31	19	28	475
XAH	B	S-P	4	4	3½ x 4½	35*	1800	..	B-HM	H-E	....	....	38	19	27	385
185GLB	B	S-P	4	6	3½ x 3¾	48*	2000	..	B-HM	H-E	....	....	31	22	30	675
185DLC	A	S-P	4	6	3½ x 3¾	44*	2000	B	....	H-E	....	....	31	22	30	675
190GLB	B	S-P	4	6	3¾ x 4	58*	2000	..	B-HM	H-E	....	....	43	22	30	690
190DLCA	A	S-P	4	6	3¾ x 4	58†*	2000	B	....	H-E	....	....	43	22	29	868
195GL	B	S-P	4	6	4 x 4	65*	2000	..	B-HM	H-E	....	....	43	22	30	775
195DLCA	A	S-P	4	6	4 x 4	67†*	2000	B	....	E	....	....	43	26	30	965
195GK	B	S-P	4	6	4½ x 4	71*	2000	..	B-HM	H-E	....	....	44	22	30	780
MZA	B	S-P	4	6	4½ x 4¾	64*	1600	..	B-HM	H-E	....	....	44	21	34	920
135GK	B	S-P	4	6	4½ x 5	86*	1800	..	B-HM	E	....	....	47	26	38	1325
135DKB	A	S-P	4	6	4½ x 5	99†*	2000	B	....	E	....	....	48	26	35	1386
135DKBS	A	S-P	4	6	4½ x 5	121†*	2000	B	....	E	T	....	48	26	41	1486
135GZ	B	S-P	4	6	4½ x 5	92*	1800	..	B-HM	E	....	....	48	26	38	1325
140GKB	B	S-P	4	6	4½ x 5½	122†*	1800	..	B-HM	E	....	....	52	26	43	1390
145GKB	B	S-P	4	6	5¼ x 6	157†*	1800	..	B-HM	E-G	....	....	56	29	47	1810
148DKB	A	S-P	4	6	5¼ x 6	147†*	1800	B	....	E-G	....	....	56	29	47	2320
148DKBS	A	S-P	4	6	5¼ x 6	194†*	1800	B	....	E-G	T	....	56	29	56	2445
145GZB	B	S-P	4	6	5¼ x 6	164†*	1800	..	B-HM	E-G	....	....	56	29	47	1820
WAKB	B	S-P	4	6	6¼ x 6½	227†*	1600	..	HM	E-G	....	....	67	33	51	3150
WAKR	B	S-P	4	6	6¼ x 6½	217*	1600	..	HM	E-G	....	....	67	33	51	3050
WAKDB	A	S-P	4	6	6¼ x 6½	195†*	1600	B	....	E-G	....	....	67	33	51	3800
WAKDBS	A	S-P	4	6	6¼ x 6½	259†*	1600	B	....	E-G	T	....	67	33	63	3925
NKRB	B	S-P	4	6	7 x 8¼	260*†	1200	..	HM	G	....	....	79	48	61	6900
NKDB	A	S-P	4	6	7 x 8¼	238†*	1200	B	....	G	....	....	79	48	61	9285
NKDBS	A	S-P	4	6	7 x 8¼	312†*	1200	B	....	G	T	....	79	48	61	9435
LRORB	B	S-P	4	6	8½ x 8½	372*	1200	..	HM	G	....	....	98	49	70	9940
LRDB	A	S-P	4	6	8½ x 8½	332†*	1200	B	....	G	....	....	98	49	70	10300
LRDBS	A	S-P	4	6	8½ x 8½	456†*	1200	B	....	G	T	....	114	49	70	10450
LRZB	B	S-P	4	6	9½ x 8½	475†*	1200	..	HM	G	....	....	114	60	73	11250
VLROB	B	S-P	4	12	8½ x 8½	720	1200	..	HM	G	....	....	130	60	58	15000
VLRDB	A	S-P	4	12	8½ x 8½	664	1200	B	....	G	....	....	130	60	58	15500
VLRDBS	A	S-P	4	12	8½ x 8½	908	1200	B	....	G	T	....	134	60	58	16300

** Continuous hp ratings are based on 80 per cent of maximum at speeds indicated. Gas ratings on natural gas & LPG are approximately 10 per cent lower. † Counterbalanced crankshaft.*

Lorain Engines—White-Roth Machine Corporation
Lorain, Ohio

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
L	B	S	2	1	7½ x 8	27	600	..	HM	H-G	....	....	72	50	48	2810
LD	A	S	2	1	7½ x 8	23	600	S	....	G	....	....	72	50	48	2810
O	B	S	2	1	9½ x 10	42	500	..	HM	H-G	....	....	88	60	51	4300

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
OD	A	S	2	1	9¼ x 10	34	500	S	....	G	....	....	88	60	51	4300
R	B	S	2	1	12 x 13	60	350	..	HM	G	....	....	112	71	66	8000
A	B	S	2	1	13 x 13	67	350	..	HM	G	....	....	112	72	66	8800
AD	A	S	2	1	13 x 13	55	350	S	....	G	....	....	112	72	66	8500

Witte Engine Works
Oil Well Supply Division, U. S. Steel Corporation
Kansas City 26, Missouri

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
AD	A	S-P	4	1	3½ x 4½	4–5.5	1200–1500	B-D	....	H-E	....	....	24	24	33	450
BD	A	S-P	4	1	4½ x 6	8	900	B-D	....	H-E	....	....	46	34	28	930
LD	A	S-P	4	1	4½ x 6¼	9	1350	B-D	....	H-E	....	....	29	28	44	842
CD	A	S-P	4	1	5 x 8	12.5	750	B	....	H-E	....	....	58	36	37	1352
B	B	S-P	4	1	5 x 6	10	900	..	HM	H	....	....	47	39	42	1285
C	B	S-P	4	1	6 x 8	15.5	750	..	HM	H	....	....	57	47	49	1760
98	B	S-P	4	1	5 x 5	10	1200	..	HM	H-E	....	....	39	36	36	655

Wolverine Motor Works, Inc.
Bridgeport, Conn.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
WM426	A	M	4	6	4¼ x 5	100	1600	B	....	A-E	....	S	83	25	40	2300
WM426T	A	M	4	6	4¼ x 5	120	1600	B	....	A-E	T	S	83	25	40	2600
WM779	A	M	4	6	5¼ x 6	150	1400	B	....	A-E	....	S	94	40	49	3100
WM779T	A	M	4	6	5¼ x 6	180	1400	B	....	A-E	T	S	94	46	49	3400
WM1197	A	M	4	6	6¼ x 6½	210	1400	B	....	A-E	....	S	110	40	54	5600
WM1197T	A	M	4	6	6¼ x 6½	275	1400	B	....	A-E	T	S	110	47	54	5900
WM1905	A	M	4	6	7 x 8¼	280	1100	B	....	A-E	....	S	141	41	64	10000
WM1905T	A	M	4	6	7 x 8¼	360	1100	B	....	A-E	T	S	141	44	64	10400
WM2894	A	M	4	6	8½ x 8½	400	1100	B	....	A-E	....	S	171	46	84	12000
WM2894T	A	M	4	6	8½ x 8½	525	1100	B	....	A-E	T	S	171	60	84	12500
WM2980	A	M	4	5	8½ x 10½	200	650	S	....	A	....	S	133	37	61	12500
WM3570	A	M	4	6	8½ x 10½	240	650	S	....	A	....	S	147	37	61	14400
WM3570T	A	M	4	6	8½ x 10½	360	650	S	....	A	T	S	155	44	79	15200
WM4725	A	M	4	5	9¼ x 14	200	400	O	....	A	....	D	162	38	75	19200
WM5669	A	M	4	6	9¼ x 14	240	400	O	....	A	....	D	182	38	75	21000
WM7559	A	M	4	8	9¼ x 14	320	400	O	....	A	....	D	213	38	75	24750

Worthington Corporation
Harrison, New Jersey

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
W9-6	D	S-P	4	6	9 x 11	425	900	..	....	A	....	....	...	...	...	.....
W9-8	D	S-P	4	8	9 x 11	570	900	..	....	A	....	....	...	...	...	.....
SW9-6	D	S-P	4	6	9 x 11	955	900	..	....	A	T	....	...	...	...	.....
SW9-8	D	S-P	4	8	9 x 11	1275	900	..	....	A	T	....	...	...	...	.....
DH5	D	S-P	4	5	12 x 14	510	600	..	....	A	....	....	...	...	...	.....
DH6	D	S-P	4	6	12 x 14	610	600	..	....	A	....	....	...	...	...	.....
DH8	D	S-P	4	8	12 x 14	815	600	..	....	A	....	....	...	...	...	.....
SDH5	D	S-P	4	5	12 x 14	830	600	..	....	A	T	....	...	...	...	.....
SDH6	D	S-P	4	6	12 x 14	990	600	..	....	A	T	....	...	...	...	.....
SDH8	D	S-P	4	8	12 x 14	1325	600	..	....	A	T	....	...	...	...	.....
SCC5	D	S	4	5	10¾ x 14½	515	514	..	....	A	T	....	...	...	...	.....
SCC6	D	S	4	6	10¾ x 14½	615	514	..	....	A	T	....	...	...	...	.....
SCC7	D	S	4	7	10¾ x 14½	720	514	..	....	A	T	....	...	...	...	.....
SCC8	D	S	4	8	10¾ x 14½	825	514	..	....	A	T	....	...	...	...	.....
DR5	D	S	4	5	13¼ x 17½	580	450	..	....	A	....	....	...	...	...	.....
DR6	D	S	4	6	13¼ x 17½	700	450	..	....	A	....	....	...	...	...	.....
DR7	D	S	4	7	13¼ x 17½	815	450	..	....	A	....	....	...	...	...	.....
DR8	D	S	4	8	13¼ x 17½	930	450	..	....	A	....	....	...	...	...	.....
SDR5	D	S	4	5	13¼ x 17½	1020	450	..	....	A	T	....	...	...	...	.....
SDR6	D	S	4	6	13¼ x 17½	1230	450	..	....	A	T	....	...	...	...	.....
SDR7	D	S	4	7	13¼ x 17½	1435	450	..	....	A	T	....	...	...	...	.....
SDR8	D	S	4	8	13¼ x 17½	1635	450	..	....	A	T	....	...	...	...	.....
EH5	C	S	4	5	16 x 20	730	360	..	....	A	....	....	...	...	...	.....
EH6	C	S	4	6	16 x 20	880	360	..	....	A	....	....	...	...	...	.....
EH7	C	S	4	7	16 x 20	1025	360	..	....	A	....	....	...	...	...	.....
EH8	C	S	4	8	16 x 20	1170	360	..	....	A	....	....	...	...	...	.....
SEH5	D	S	4	5	16 x 20	1285	360	..	....	A	T	....	...	...	...	.....
SEH6	D	S	4	6	16 x 20	1545	360	..	....	A	T	....	...	...	...	.....
SEH7	D	S	4	7	16 x 20	1800	360	..	....	A	T	....	...	...	...	.....
SEH8	D	S	4	8	16 x 20	2055	360	..	....	A	T	....	...	...	...	.....
SW14-6	D	S	4	6	14 x 18	1875	450	..	....	A	T	....	...	...	...	.....
SW14-8	D	S	4	8	14 x 18	2500	450	..	....	A	T	....	...	...	...	.....
SW14-12	D	S	4	12	14 x 18	3750	450	..	....	A	T	....	...	...	...	.....
SW14-16	D	S	4	16	14 x 18	5000	450	..	....	A	T	....	...	...	...	.....
BBG5	B	S-P	4	5	9 x 10½	205	600	..	....	A	....	....	...	...	...	.....
BBG6	B	S-P	4	6	9 x 10½	245	600	..	....	A	....	....	...	...	...	.....
CCG5	B	S-P	4	5	12¼ x 14½	445	514	..	....	A	....	....	...	...	...	.....
CCG6	B	S-P	4	6	12¼ x 14½	530	514	..	....	A	....	....	...	...	...	.....
CCG7	B	S-P	4	7	12¼ x 14½	620	514	..	....	A	....	....	...	...	...	.....
CCG8	B	S-P	4	8	12¼ x 14½	710	514	..	....	A	....	....	...	...	...	.....
DDG5	B	S	4	5	15 x 17½	560	360	..	....	A	....	....	...	...	...	.....
DDG6	B	S	4	6	15 x 17½	675	360	..	....	A	....	....	...	...	...	.....
DDG7	B	S	4	7	15 x 17½	785	360	..	....	A	....	....	...	...	...	.....
DDG8	B	S	4	8	15 x 17½	900	360	..	....	A	....	....	...	...	...	.....
EHGL5	B	S	4	5	16¾ x 20	800	360	..	....	A	....	....	...	...	...	.....
EHGL6	B	S	4	6	16¾ x 20	960	360	..	....	A	....	....	...	...	...	.....
EHGL7	B	S	4	7	16¾ x 20	1120	360	..	....	A	....	....	...	...	...	.....
EHGL8	B	S	4	8	16¾ x 20	1280	360	..	....	A	....	....	...	...	...	.....
SEHGL5	B	S	4	5	16¾ x 20	1300	360	..	....	A	T	....	...	...	...	.....
SEHGL6	B	S	4	6	16¾ x 20	1565	360	..	....	A	T	....	...	...	...	.....
SEHGL7	B	S	4	7	16¾ x 20	1825	360	..	....	A	T	....	...	...	...	.....
SEHGL8	B	S	4	8	16¾ x 20	2085	360	..	....	A	T	....	...	...	...	.....

Petter Engine Division of Brush ABOE Inc.
60-07 39th Avenue, Woodside 77, New York

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
PAZ1*	A	S-P	4	1	3 x 3	2½	1500	**	....	H	....	....	18	18	26	260
AVA1*	A	S-P	4	1	3.15 x 4.33	6	1800	**	....	E-H	....	....	30	21	30	390
AVA2*	A	S-P	4	2	3.15 x 4.33	12	1800	**	....	E-H	....	....	37	21	32	558
AV1	A	S-P	4	1	3.15 x 4.33	6	1800	**	....	E-H	....	....	30	21	29	406
AV2	A	M-S-P	4	2	3.15 x 4.33	10-12	1500-1800	**	....	E-H	....	†	37	21	32	598
B2	A	M-S-P	4	2	4.33 x 4.33	20	1500	**	....	E-H	....	†	46	28	41	907
B3	A	M-S-P	4	3	4.33 x 4.33	30	1500	**	....	E-H	....	†	56	28	41	1211
B4	A	M-S-P	4	4	4.33 x 4.33	40	1500	**	....	E-H	....	†	62	23	41	1491

* *Air cooled.* ** *Bryce.* † *Parsons.* *Dimensions are for "S"& "P" units.*

Bamfords——International Selling Corporation
122 E. 42nd Street, New York 17, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
Z1	A	M-S	4	1	4⅛ x 5	3½	600	*	....	H-E	....	....	38	26	41	950
Z2	A	M-S	4	1	4⅛ x 5	4½-5½	600-700	*	....	H-E	....	....	38	26	41	965
Z3&4	A	M-S	4	1	5 x 6	7-8	600-700	*	....	H-E	....	....	42	39	28	1050
Z7&8	A	M-S	4	2	5 x 6	14-16	600-700	*	....	H-E	....	....	48	28	42	1470

* *C.A.V.*

Burmeister & Wain American Corporation
17 Battery Place, New York 4, N.Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
20MT-30	A	S	4	2-6	7.9 x 11.8	35*	600	O	....	A	....	....	....	....	....	.....
20MTB-30	A	S	4	3-6	7.9 x 11.8	50*	600	O	....	A	T	....	....	....	....	.....
25MT-40	A	S	4	2-7	9.8 x 15.7	60*	500	O	....	A	....	....	....	....	....	.....
25MTB-40	A	S	4	3-7	9.8 x 15.7	85*	500	O	....	A	T	....	....	....	....	.....
33MT-48	A	M-S	4	3-7	13.0 x 18.9	100*	400	O	....	A	....	D	....	....	....	.....
28V-50	A	M-S	2	4-9	11.0 x 19.7	122*	360	O	....	A	....	D††	....	....	....	.....
33MTB-48	A	M-S	4	3-7	13.0 x 18.9	140*	400	O	....	A	T	D	....	....	....	.....
28VB-50	A	M-S	2	5-9	11.0 x 19.7	175*	360	O	....	A	T	D††	....	....	....	.....
35V-62	A	M-S	2	4-10	13.8 x 24.4	200*	300	O	....	A	....	D	....	....	....	.....
42V-75	A	M-S	2	4-10	16.5 x 29.5	240*	240	O	....	A	....	D	....	....	....	.....
35VB-62	A	M-S	2	5-10	13.8 x 24.4	270*	300	O	....	A	T	D	....	....	....	.....
42VB-75	A	M-S	2	5-10	16.5 x 29.5	324*	240	O	....	A	T	D	....	....	....	.....
50V-90	A	M-S	2	4-10	19.7 x 35.4	410*	200	O	....	A	....	D	....	....	....	.....
50VT-110	A	M-S	2	4-10	19.7 x 43.3	420*	170	O	....	A	....	D	....	....	....	.....
50VB-90	A	M-S	2	5-10	19.7 x 35.4	554*	200	O	....	A	T	D	....	....	....	.....
50VTB-110	A	M-S	2	5-10	19.7 x 43.3	567*	170	O	....	A	T	D	....	....	....	.....
74T-150	A	M-S	4	6-10	29.1 x 59.0	575*	120	O	....	A	....	D	....	....	....	.....
50VT-110/40	A	M-S	2	4-10	19.7 x 43.3/15.7	585*	170	O	....	A	....	D	....	....	....	.....
62V-115	A	M-S	2	4-10	24.4 x 45.3	600*	150	O	....	A	....	D	....	....	....	.....
62VT-115	A	M-S	2	4-10	24.4 x 45.3	600*	150	O	....	A	....	D	....	....	....	.....
62VT-140	A	M-S	2	4-12	24.4 x 55.1	655	135	O	....	A	....	D	....	....	....	.....
50VBT-110/40	A	M-S	2	5-10	19.7 x 43.3/15.7	790*	170	O	....	A	T	D	....	....	....	.....
62VB-115	A	M-S	2	5-10	24.4 x 45.3	810*	150	O	....	A	T	D	....	....	....	.....
62VTB-115	A	M-S	2	5-10	24.4 x 45.3	810*	150	O	....	A	T	D	....	....	....	.....
74VT-140	A	M-S	2	4-10	29.1 x 55.1	875*	125	O	....	A	....	D	....	....	....	.....
62VTB-140	A	M-S	2	5-12	24.4 x 55.1	900	135	O	....	A	T	D	....	....	....	.....
74VT-160	A	M-S	2	5-12	29.1 x 63.0	920*	115	O	....	A	....	D	....	....	....	.....
74VTB-140	A	M-S	2	5-12	29.1 x 55.1	1190*	125	O	....	A	T	D	....	....	....	.....
75VT-150/50	A	M-S	2	4-10	29.5 x 59.0/19.7	1230*	120	O	....	A	....	D	....	....	....	.....
74VTB-160	A	M-S	2	5-12	29.1 x 63.0	1250*	115	O	....	A	T	D	....	....	....	.....
75VT-170/60	A	M-S	2	4-10	29.5 x 66.9/23.6	1300*	110	O	....	A	....	D	....	....	....	.....
75VTB-150/50	A	M-S	2	4-10	29.5 x 59.0/19.7	1650*	120	O	....	A	T	D	....	....	....	.....
75VTB-170/60	A	M-S	2	4-10	29.5 x 66.9/23.6	1755*	110	O	....	A	T	D	....	....	....	.....
B&W-340†	A	M	2	2-4	7.9 x 13.4	45*	450	O	....	A	....	††	....	....	....	.....
B&W-400†	A	M	2	2-6	9.1 x 15.7	60*	375	O	....	A	....	††	....	....	....	.....
BUKH-EV80	A	M-S-P	4	1	3.1 x 4.3	6*	1800	B	....	E-H**	....	....	....	....	....	.....
BUKH-EV100	A	M-S-P	4	1-3	3.9 x 5.1	10*	1500	B	....	E-H**	....	††	....	....	....	.....

* *Hp per cylinder.* ** *Also cartridge start.* † *Alpha engine.* †† *Controllable pitch propeller and sailing clutch of own manufacture. On models with dual stroke, shorter stroke is for exhaust piston.*

Crofton Industrial Diesel Engines
San Diego 1, California

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
6-1A	A	....	4	1	3 5/16 x 3 11/16	4	1500	B	....	H-E	....	....	28*	19	28	235
4-1W	A	M-S	4	1	3 5/16 x 3 11/16	5-7	1500	B	....	H-E	....	....	39	18	27	246
5-1W	A	M-S	4	1	3 11/16 x 3 11/16	7-9	1500	B	....	H-E	....	....	39	18	27	266
7-1W	A	M-S	4	1	3 11/16 x 3 15/16	9-11	1500	B	....	H-E	....	....	39	18	27	275

* *Includes starting handle. Ricardo type precombustion system is used.*

Henschel & Sohn GmbH
Kassel, Germany

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
515DE	A	M-S-P	4	2	3.51 x 4.92	18-21	1800	†	....	E	....	....	25	29	32	505
519D2	A	M-S-P	4	2	4.12 x 5.12	23-27	1800	†	....	E	....	....	28	22	35	605
516DF	A	M-S-P	4	4	3.51 x 4.92	41-48	2000	†	....	E	....	....	35	32	33	770
517D4	A	M-S-P	4	4	3.93 x 5.12	67-84	2200-2500	†	....	E	....	....	34	27	35	725

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fue System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
512DG	A	M-S-P	4	6	3.78 x 4.92	79-101	2000-2200	†	....	E	....	....	45	24	43	925
512DJ	A	M-S-P	4	6	3.78 x 4.92	79-106	2000-2400	†	....	E	....	....	49	26	41	990
522DP	A	M-S-P	4	6	3.93 x 5.12	101-127	2200-2500	†	....	E	....	....	44	26	42	1025
522DPU*	A	P	4	6	3.93 x 5.12	127	2500	†	....	E	....	....	50	50	18	1100
513DC	A	M-S-P	4	6	4.32 x 5.90	120-148	2000-2200	†	....	E	....	....	53	33	44	1330
514DCU*	A	P	4	6	4.53 x 5.90	170	2200	†	....	E	....	....	52	48	22	1430
520DO	A	M-S-P	4	6	4.92 x 5.90	151-185	1800-2000	†	....	E	....	....	53	36	47	1480
521DS	A	M-S-P	4	6	5.31 x 6.1	150-175	1600-1800	†	....	E	....	....	64	31	50	2200
521DU*	A	M-S-P	4	6	5.31 x 6.1	150-175	1600-1800	†	....	E	....	....	70	56	22	2250
521DS-L	A	M-S-P	4	6	5.31 x -.1	200-250	1600-1800	†	....	E	T	....	67	31	50	2400
521DU-L*	A	M-S-P	4	6	5.31 x -.1	200-250	1600-1800	†	....	E	T	....	73	56	24	2450
583D8V	A	M-S-P	4	8	5.31 x 6.1	200-230	1600-1800	†	....	E	....	....	51	39	48	2800
583D8V-L	A	M-S-P	4	8	5.31 x 6.1	260-330	1600-1800	†	....	E	T	....	51	39	51	3100
580D12V	A	M-S-P	4	12	5.31 x 6.1	300-350	1600-1800	†	....	A-E	....	....	70	39	48	3200
580D12V-L	A	M-S-P	4	12	5.31 x 6.1	400-500	1600-1800	†	....	A-E	T	....	73	39	51	3750

** Horizontal Engine, † Robert Bosch Equipment. For first 11 engines, low end of hp & rpm range is for "S" and "M" applications—High end is for "P". For remaining engines, high end is for railcar, low end for "M", "S" and "P".*

Klockner-Humboldt-Duetz———Diesel Energy Corporation
82 Beaver Street New York 6, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MAH711	A	M-S-P	4	1	3 1/16 x 4 1/16	6	1500	O	....	H	....	....	31	24	21	374
MAH914	A	M-S-P	4	1	4 x 5 1/2	11	1500	O	....	H	....	....	39	30	26	693
MAH916	A	S-P	4	1	4 3/4 x 6 3/16	16	1300	O	....	H-A	....	....	44	35	28	957
MAH320	A	S-P	4	1	6 1/4 x 7 1/2	26	1000	O	....	H-A	....	....	55	39	32	1694
F2M417	A	S-P	4	2	4 3/4 x 6 3/16	32	1800	O	....	H-E	....	....	35	29	44	1441
F1&2L612	A*	M-S-P	4	1 & 2	3 1/2 x 4 1/2	10 & 20	2000	O	....	H-E	....	....	24&31	21	31	506**
F4L612	A*	P	4	4	3 1/2 x 4 1/2	60	2800	†	....	E	....	....	35	25	33	594
A1-6L514	A*	M-S-P	4	1-4 & 6	4 1/8 x 5 1/2	16-100	1800	†	....	H-E	....	....	63	33	40	1606**
A6L614	A*	S-P	4	V-6	4 1/8 x 5 1/2	100	1800	†	....	E	....	....	39	46	25	1672
A8L614	A*	M-S-P	4	V-8	4 1/8 x 5 1/2	130	1800	†	....	E	....	....	43	43	36	1936
A12L614	A*	M-S-P	4	V-12	4 1/8 x 5 1/2	200	1800	†	....	E	....	....	67	48	35	2794
F1L514	A*	P	4	1	4 1/8 x 5 1/2	16	1800	O	....	H-E	....	....	22	24	41	723
A2-6L514	A*	P	4	2-4 & 6	4 1/8 x 5 1/2	32-125	1800-2300	O†	....	H-E	....	....	63	33	40	1430**
A6L614	A*	P	4	V-6	4 1/8 x 5 1/2	125	2300	†	....	E	....	....	39	46	25	1595
A8L614	A*	P	4	V-8	4 1/8 x 5 1/2	170	2300	†	....	E	....	....	43	43	36	1870
A12L614	A*	P	4	V-12	4 1/8 x 5 1/2	250	2300	†	....	E	....	....	67	48	44	2750
A4-8M517	A	M-S-P	4	4, 6 & 8	5 1/16 x 6 1/4	83-170	1500	†	....	A-E	....	....	84	30	46	2992**
BA8M517	A	M-S-P	4	8	5 1/16 x 6 1/4	250	1500	†	....	E	T	....	84	30	51	3300
F6M617	A	P	4	6	5 1/16 x 6 1/4	175	1800	†	....	E	....	....	63	30	48	2420
T4M320	A	M-S-P	2	V-4	6 1/2 x 7 1/2	133	800	O	....	A-E	....	....	50	52	51	3110
T8M320	A	M-S-P	2	V-8	6 1/2 x 7 1/2	267	800	O	....	A-E	....	....	80	48	61	4895
T12M310	A	M-S-P	2	V-12	6 1/2 x 7 1/2	400	800	O	....	A-E	....	....	98	48	63	7040
T4M420	A	M-S-P	2	V-4	6 3/4 x 7 1/2	167	1000	O	....	E	....	....	50	52	51	3245
T8M420	A	M-S-P	2	V-8	6 3/4 x 7 1/2	333	1000	O	....	E	....	....	80	48	61	4730
T12M420	A	M-S-P	2	V-12	6 3/4 x 7 1/2	500	1000	O	....	E	....	....	98	52	63	6600
T2-4M425	A	M-S-P	2	2-4	6 1/2 x 9 1/2	47-95	600	O	....	A	....	....	71	37	56	6380**
T4M525	A	M-S-P	2	V-4	6 1/2 x 9 1/2	216	650	O	....	A	....	D	64	59	77	6710
T8M525	A	M-S-P	2	V-8	6 1/2 x 9 1/2	433	650	O	....	A	....	D	69	59	77	9790
T12M525	A	M-S-P	2	V-12	6 1/2 x 9 1/2	650	650	O	....	A	....	D	117	59	77	12540
T4M625	A	M-S-P	2	V-4	6 1/2 x 9 1/2	250	750	O	....	A	....	D	64	59	77	6710
T8M625	A	M-S-P	2	V-8	6 1/2 x 9 1/2	500	750	O	....	A	....	D	69	59	77	9790
T12M625	A	M-S-P	2	V-12	6 1/2 x 9 1/2	750	750	O	....	A	....	D	117	59	77	12540
T4M233	A	M-S-P	2	4	8 3/4 x 13	250	500	†	....	A	....	D	93	58	73	10120
T8M233	A	M-S-P	2	V-8	8 3/4 x 13	500	500	†	....	A	....	D	110	97	71	14520
A4-8M428	A	M-S-P	4	4, 6 & 8	8 3/4 x 11	150-310	600	O	....	A	....	D	116	36	65	12650**
V6M436	A	M-S-P	4	6	9 1/2 x 14 1/2	300	500	O	....	A	....	D	134	42	77	21230
V6&8M536	A	M-S-P	4	6 & 8	10 5/8 x 14 1/2	375 & 500	500	O	....	A	....	D	164	42	83	27500**
V6&8M545	A	M-S	4	6 & 8	12 5/8 x 17 3/4	500 & 660	375	O	....	A	....	D	196	53	95	41800**
BV6&8M536	A	M-S-P	4	6 & 8	10 5/8 x 14 1/2	560 & 750	500	O	....	A	T	D	170	42	94	27940**
BV6&8M545	A	M-S	4	6 & 8	12 5/8 x 17 3/4	800 & 1060	375	O	....	A	T	D	201	53	129	43230**
V6&8M366	A	M-S	4	6 & 8	16 1/2 x 26	915 & 1210	275	O	....	A	....	D	295	72	142	117920**
BV6&8M366	A	M-S	4	6 & 8	16 1/2 x 26	1500 & 2000	275	O	....	A	T	D	300	72	173	119460**

** Air cooled. † Denotes Robert Bosch Equipment. ** Where range of engines is shown, weights and dimensions are for largest engine in range. In most cases, width and height are the same for all engines in the range.*

Maschinenbau Kiel Aktiengesellschaft
Mak, Kiel, Germany

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Super-Charge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MZ582	A	M-S	4	10	15 5/16 x 22 31/64	1250	300	*	....	A	....	D	335	56	137	122000
MA582	A	M-S	4	8	15 5/16 x 22 31/64	1000	300	*	....	A	....	D	280	56	137	95000
MS582	A	M-S	4	6	15 5/16 x 22 31/64	750	300	*	....	A	....	D	226	56	137	80000
MZ582A	A	M-S	4	10	15 5/16 x 22 31/64	1920	300	*	....	A	T	D	335	56	137	126000
MN582A	A	M-S	4	9	15 5/16 x 22 31/64	1720	300	*	....	A	T	D	305	56	137	115000
MA582A	A	M-S	4	8	15 5/16 x 22 31/64	1530	300	*	....	A	T	D	280	56	137	102000
MS582A	A	M-S	4	6	15 5/16 x 22 31/64	1150	300	*	....	A	T	D	226	56	137	82000
4Z42	A	M-S	2	4	11 37/64 x 16 17/32	500-600	370-428	*	....	A	....	D	138	75	105	26500
6Z42	A	M-S	2	6	11 37/64 x 16 17/32	750-900	370-428	*	....	A	....	D	175	75	105	36000
8Z42	A	M-S	2	8	11 37/64 x 16 17/32	1000-1200	370-428	*	....	A	....	D	210	75	105	46000
MV423	A	M-S	4	4	11 37/64 x 16 17/32	240-265	340-375	*	....	A	....	D	120	48	93	21000
MS423	A	M-S	4	6	11 37/64 x 16 17/32	390-450	370-428	*	....	A	....	*	155	48	93	30000
MA423	A	M-S	4	8	11 37/64 x 16 17/32	520-600	375-428	*	....	A	....	D	189	48	93	37000
MS423A	A	M-S	4	6	11 37/64 x 16 17/32	560-690	370-428	*	....	A	T	D	155	48	93	31000
MA423A	A	M-S	4	8	11 37/64 x 16 17/32	760-920	375-428	*	....	A	T	D	189	48	93	40000
MD36	A	M-S	4	3	8 15/16 x 14 1/16	90-120	375-500	*	....	A	....	D	84	44	79	9900
MV36	A	M-S	4	4	8 15/16 x 14 1/16	120-160	375-500	*	....	A	....	*	98	44	79	11900
MS36	A	M-S	4	6	8 15/16 x 14 1/16	180-240	375-500	*	....	A	....	D	125	44	79	16400
MS36A	A	M-S	4	6	8 15/16 x 14 1/16	270-360	375-500	*	....	A	T	D	125	44	80	17200
MS301	A	M-S-P	4	6	9 1/16 x 11 15/16	400	750	*	....	A	....	*	115	35	75	13900
MA301	A	M-S-P	4	8	9 1/16 x 11 15/16	525	750	*	....	A	....	*	140	35	75	17200
MS301A	A	M-S-P	4	6	9 1/16 x 11 15/16	575	750	*	....	A	T	*	118	35	75	14600
MS301C	A	M-S-P	4	6	9 1/16 x 11 15/16	650	750	*	....	A	T	*	134	35	75	14600
MS301CK	A	M-S-P	4	6	9 1/16 x 11 15/16	750	750	*	....	A	T	*	137	35	75	14900
MA301A	A	M-S-P	4	8	9 1/16 x 11 15/16	800	750	*	....	A	T	*	162	35	78	17900
MA301C	A	M-S-P	4	8	9 1/16 x 11 15/16	900	750	*	....	A	T	*	171	35	79	17900
MA301CK	A	M-S-P	4	8	9 1/16 x 11 15/16	1000	750	*	....	A	T	*	167	35	79	18100
MV24	A	M-S-P	4	4	7 1/16 x 9 15/16	80-160	500-1000	*	....	A-E	....	*	68	33	57	6200
MS24	A	M-S-P	4	6	7 1/16 x 9 15/16	120-240	500-1000	*	....	A-E	....	*	68	33	57	8400

** Make not known.*

Maschinenfabrik-Augsburg-Nuernberg A. G.
H. A. Stechel, 149 Broadway, New York 6, N. Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
D9614	A†††	M-S-P	4	4	3.78 x 4.33	40	2000	†	....	E	....	....	32	24	33	1000
D1246	A†††	M-S-P	4	6	4.41 x 5.51	100	2000	†	....	E	....	....	47	25	40	1410
D1548	A†††	M-S-P	4	8	4.53 x 5.51	135	2000	†	....	E	....	....	44	43	49	1820
D1548mA	A†††	M-S-P	4	8	4.53 x 5.51	170	2000	†	....	E	T	....	44	43	49	1895
WV14/18	D	M-S-P	4	4 & 6	5.51 x 7.08	95 & 180	1200&1500	†	....	A-E	....	....	45&62	25	46	.....
WV14/18mA	A	M-S-P	4	6	5.51 x 7.08	275	1500	†	....	A-E	T	....	78	25	50	4300
WV17.5/22A	D	M-S-P	4	3–8	6.89 x 8.66	100–320	900–1200	†	....	A-E	....	....	44-98	32	53-57	.....
WV17.5/22AmA	A	M-S-P	4	6 & 8	6.89 x 8.66	310–460	1000–1200	†	....	A	T	....	93&115	32	55&63	.....
WV22/30A	A	M-S-P	4	6 & 8	8.66 x 11.81	330–520	750–900	†	....	A	....	....	98&122	30	74	.....
WV22/30AmA	A	M-S-P	4	6 & 8	8.66 x 11.81	610–950	750–900	†	....	A	T	....	98&122	30	75&78	.....
VV22/30	A	M-S-P	4	12 & 16	8.66 x 11.81	660–1040	750–900	†	....	A	....	....	...	...	...	.....
VV22/30mA	A	M-S-P	4	12 & 16	8.66 x 11.81	1220–1900	750–900	†	....	A	T	....	...	...	...	.....
WV30/38A	A	M-S	4	6,8,10&12	12.99 x 14.96	620–1440	600–700	†	....	A	....	D	...	...	...	.....
WV30/38AmA	A	M-S	4	6,8,10&12	12.99 x 14.96	985–2300	600–700	†	....	A	T	D	...	...	...	.....
LV17.5/21B	A	M-S-P	4	12	6.89 x 8.27	500–700	1400–1500	†	....	A-E	....	....	78	28	59	6590
LV17.5/21BmA	A	M-S-P	4	12	6.89 x 8.27	720–1000	1400–1500	†	....	A-E	T	....	78	28	76	7470
GV23.5/33	D	M-S	4	3–8	9.25 x 12.99	145–440	514–600	O	....	A	....	D	...	...	...	.....
GV23.5/33mA	D	M-S	4	6–8	9.25 x 12.99	515–685	600	O	....	A	T	D	...	...	...	.....
GV28.5/42A	D	M-S	4	3–8	11.21 x 16.53	205–550	428	O	....	A	....	D	...	...	...	.....
GV28.5/42AmA	D	M-S	4	6–8	11.21 x 16.53	860–880	428	O	....	A	T	D	...	...	...	.....
GV40/60	D	M-S	4	5–10	15.75 x 23.62	655–1430	273–300	O	....	A	....	D	...	...	...	.....
GV40/60mA	D	M-S	4	5–10	15.75 x 23.62	1050–2280	273–300	O	....	A	T	D	...	...	...	.....
GV52/74A	D	M-S	4	6–10	20.47 x 29.13	1500–2500	250	O	....	A	....	D	...	...	...	.....
GV52/74AmA	D	M-S	4	6–10	20.47 x 29.13	2400–4000	250	O	....	A	T	D	...	...	...	.....
KV45/66mHA	A††	M-S	4	6–8	17.71 x 25.98	2800–3780	250	O	....	A	T*	D	...	...	...	.....
GZ52/70	A	M-S	2	5–10	20.47 x 27.56	1920–4250	225–250	O	....	A	....	D	...	...	...	.....
GZ52/90	A	M-S	2	5–10	20.47 x 35.43	1650–4100	150–187	O	....	A	....	D	...	...	...	.....
KZ57/80	A††	M-S	2	5–10	22.44 x 31.50	2350–5300	200–225	O	....	A	....	D	...	...	...	.....
KZ57/80mA	A††	M-S	2	6–10	22.44 x 31.50	3990–6650	225	O	....	A	T	D	...	...	...	.....
KZ60/105	A††	M-S	2	5–10	23.62 x 41.34	2840–5670	167	O	....	A	....	D	...	...	...	.....
KZ60/105mA	A††	M-S	2	6–10	23.62 x 41.34	4240–7070	167	O	....	A	T	D	...	...	...	.....
KZ70/120	A††	M-S	2	4–10	27.56 x 47.24	2460–6950	115–130	O	....	A	....	D	...	...	...	.....
KZ70/120mA	A††	M-S	2	6–10	27.56 x 47.24	5250–8700	130	O	....	A	T	D	...	...	...	.....
KZ78/140	A††	M-S	2	6–10	30.70 x 55.10	5400–9000	115	O	....	A	....	D	...	...	...	.....
KZ78/140mA	A††	M-S	2	6–10	30.70 x 55.10	6750–11250	115	O	....	A	T	D	...	...	...	.....
DZ53/80	A**	M-S	2	4–10	20.87 x 31.50	3240–8100	214	O	....	A	....	D	...	...	...	.....
DZ60/110	A**	M-S	2	5–10	23.62 x 43.31	4280–8550	130	O	....	A	....	D	...	...	...	.....
DZ72/120	A**	M-S	2	5–10	28.34 x 47.24	6220–12450	120	O	....	A	....	D	...	...	...	.....

* *Highly supercharged.* ** *Double acting.* † *Denotes Robert Bosch Equipment.* †† *Crosshead* ††† *"Whisper" Engine (With MAN Patented Silent Combustion Principle)*

Mercedes-Benz———Europa Motors, Inc.
341 East 62nd St., New York 21, N. Y.

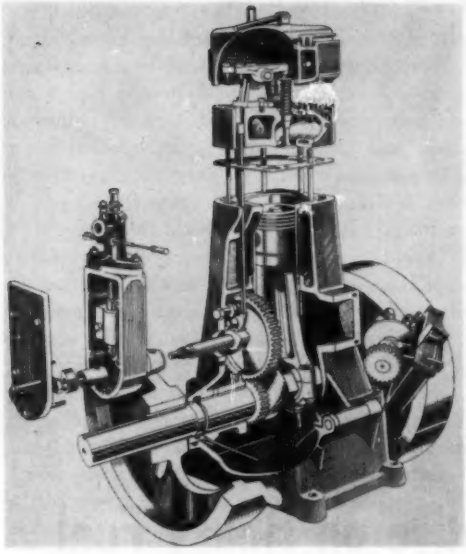
Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
MB821A	A	S-P	4	1	5 7/16 x 7 1/16	13–21	500–800	†	....	H	....	....	52	34	37	1500
M202B	A	M-S	4	2	5 1/2 x 8 1/4	28–55	550–1200	†	....	H-E-A	....	....	37	31	45	1620
M203B	A	M-S	4	3	5 1/2 x 8 1/4	40–90	550–1200	†	....	A-E	....	....	48	31	46	2090
M204B	A	M-S	4	4	5 1/2 x 8 1/4	55–120	550–1200	†	....	A-E	....	....	58	31	48	2645
OM636	A	M-S	4	4	2 15/16 x 3 15/16	19–34	1500–3000	†	....	E	....	....	29	21	30	385
OM312	A	M-S	4	6	3 9/16 x 4 3/4	50–75	1500–2400	†	....	E	....	....	37	26	42	808
OM312A	A	M-S	4	6	3 9/16 x 4 3/4	65–90	1500–2400	†	....	E	M	....	37	29	44	837
OM315	A	M-S	4	6	4 7/16 x 5 1/2	85–120	1200–1800	†	....	E	....	....	54	28	48	775
OM315A	A	M-S	4	6	4 7/16 x 5 1/2	110–150	1200–1800	†	....	E	T	....	54	39	50	1800
MB846A	A	M-S-P	4	6	5 7/16 x 7 1/2	120–225	750–1500	†	....	A-E	....	....	77	32	56	3790
MB846B*	A	M-S-P	4	6	5 7/16 x 7 1/2	120–225	750–1500	†	....	A-E	....	....	74	53	32	3790
MB846AB	A	M-S-P	4	6	5 7/16 x 7 1/2	155–300	750–1500	†	....	A-E	T	....	85	34	61	4100
MB846BB*	A	M-S-P	4	6	5 7/16 x 7 1/2	155–300	750–1500	†	....	A-E	T	....	81	56	32	4100
MB836B	A	M-S	4	6	6 1/16 x 8 1/16	255–350	1000–1500	†	....	A-E	....	....	76	40	55	3570
MB836BB	A	M-S	4	6	6 1/16 x 8 1/16	345–500	1000–1500	†	....	A-E	T-M	....	84	40	64	4080
MB820B	A	M-S	4	V-12	6 1/16 x 8 1/16	510–700	1000–1500	†	....	A-E	....	....	87	53	62	5395
MB820BB	A	M-S	4	V-12	6 1/16 x 8 1/16	690–1000	1000–1500	†	....	A-E	T-M	....	87	53	77	6070
MB820DB	A	M-S	4	V-12	6 1/16 x 8 1/16	840–1350	1000–1500	†	....	A-E	T	....	95	56	73	6660
MB518	A	M	4	V-20	7 1/16 x 9 15/16	1875–2500	1480–1630	†	....	A	T	D	158	63	89	10300

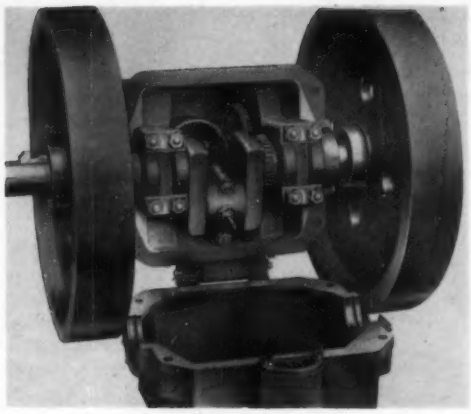
* *Horizontal engine.* † *Denotes Robert Bosch Equipment.* *Engines have precombustion chamber.*

Sulzer Bros. Ltd., New York
50 Church Street, New York 7, N.Y.

Model	Type	Use	Cycle	No. Cyl.	Bore & Stroke In.	Cont. HP.	Cont. R.P.M.	Fuel System	Ignition	Start	Supercharge	Rev. Gear	Length In.	Width In.	Height In.	Weight Lb.
BA32	C	S	4	3–8	8.67 x 12.6	200–500	500–600	O	....	A	T	....	...	...	...	.....
BA29	C	S	4	6–8	11.4 x 14.4	700–950	500	O	....	A	T	....	...	...	...	.....
BA36	A	S	4	8	14.4 x 23.6	2000	425	O	....	A	T	....	...	...	...	.....
T24	A	M	2	4&6	9.46 x 15.75	300&450	400	O	....	A	....	O-D	...	...	...	.....
T29	A	M	2	4-9	11.4 x 19.75	400-900	300	O	....	A	....	D	...	...	...	.....
T36	A	M-S	2	4-10*	14.4 x 23.6	600–1600	250–300	O	....	A	....	D	...	...	...	.....
T48	C	M-S	2	4-12†	18.9 x 27.5	1400–4200	225–250	O	....	A	....	D	...	...	...	.....
T56	A	M	2	5–8	22.1 x 39.4	2000–3200	155	O	....	A	....	D	...	...	...	.....
SD60	A	M	2	5–10	23.6 x 41	2500–5000	150	O	....	A	....	D	...	...	...	.....
SD72	A	M	2	5–12	28.3 x 49.3	3500–8400	125	O	....	A	....	D	...	...	...	.....
SF72	C	S	2	6–12	28.3 x 35.4	4590–9000	187	O	....	A	....	....	...	...	...	.....
LDA19	A	P	4	6	7.5 x	420	1100	O	....	E	T	....	...	...	...	.....
LDA22	A	P	4	6	8.67 x	570	950	O	....	E	T	....	...	...	...	.....
LDA25	A	P	4	6 & 8	9.85 x	735 & 960	850	O	....	E	T	....	...	...	...	.....
LDA28	A	P	4	6, 8 & 12	11.0 x	920–2000	750 & 935	O	....	E	T	....	...	...	...	.....
LDA31	A	P	4	12	12.3 x	2250	935	O	....	E	T	....	...	...	...	.....

* *4 to 8 for stationary.* † *5 to 12 for marine.*





Cutaway view at left illustrates simplicity of the Bamfords engine. Single cam actuates intake and exhaust valves. Governor is shown to right of block and injection mechanism at left. Hinged crankcase feature is shown above. Note how crankshaft is carried in upper base.

Bamfords Diesel Line

A LINE of small, slow-speed diesel engines is being offered in this country by Bamfords, Ltd. of England. International Selling Corp., New York, is the sole distributor for the equipment which is reportedly being offered on a national scale for the first time. The new line, called the Z Series, consists of 3½, 4½, 5½, 7, and 8 bhp in single vertical cylinder models, and 14 and 16 bhp in twin vertical cylinder models. All are of the 4-cycle slow-speed type and operate at 600 to 700 rpm. The units are designed primarily for stationary use.

According to International Selling, the line is intended to serve in a wide range of applications where fuel economy, sturdy construction, simplicity of design, and low maintenance costs are of primary importance.

Fuel economy is achieved, says the firm, by the direct injection principle of fuel feed and by the slow speed of the engines, which are thus enabled to operate at high efficiencies. Direct injection has the added advantage of retarding carbon buildup.

Simplicity of design reduces wear and maintenance costs. Overhead exhaust valves and screened inlet valves, for instance, are actuated by a single cam. Maintenance is further facilitated by the hinged crankcase, a feature unique in this line. The top half of the crankcase contains the crankshaft, main bearings, and piston and connecting rod assembly.

Removal of one set of bolts allows this segment of the crankcase to be tilted over, opening the engine and exposing working parts for easy inspection, removal, or adjustment. It is not necessary, therefore, to remove the cylinder head or disturb the injection system to effect maintenance. In addition, the governor is self-contained and can be removed as a unit.

Construction materials also play a part in reducing wear and maintenance. Cylinders are cast from close-grained cast iron and the piston, also of close-grained cast iron, is fitted with four compression rings and one oil ring. The connecting rod is drop-forged steel with a special anti-friction, thin-wall, crankpin bearing. Main bearings are solid phosphor bronze and white-metal lined. The crankshaft is drop-forged steel, heat-treated, and ground to close tolerances.

A number of other features are incorporated to add to the versatility of the line. The engines are equipped with decompression levers to facilitate starting in all weather. The line is now designed for hand-starting but will soon be available with optional electric-starting units. A 5-kw generating set will also be offered as part of the line.

The engines are water-cooled and are supplied with radiators and hoppers or fittings for tank cooling. Single-cylinder models are splash-lubricated and twin-cylinder models have pressure feed to main bearings and valve rockers. The cylinder liner is renewable, making it unnecessary to replace the cylinder.

Engines are easily coupled and require no speed reduction equipment for most driven units.

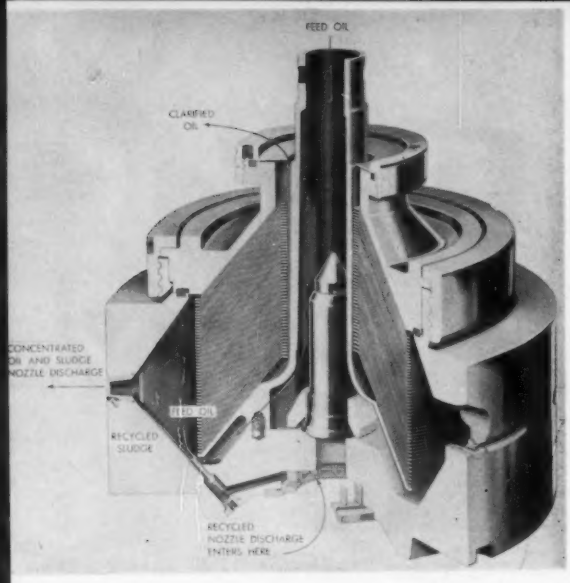


Fig. 1 Cutaway view of the recycle Nozljector bowl.

Self-Cleaning Centrifuge Effective on Heavy Fuel

Effective centrifugal purification of heavy fuels produces a lot of "bowl cake". Cleaning can be quite a chore. Read how you can obtain good purification along with self-cleaning of the bowl.

NO one likes to clean a centrifuge bowl. You can simplify the job by using paper liners and by streamlining cleaning facilities (and you should), but when you start talking about high hourly feed rates and using that very dirty stock you were shipped last month, your bowl cleaning problem becomes something to reckon with.

This is one of the maintenance factors in the burning of heavy fuel that is gaining recognition as a problem in all quarters. And something is being done about it. The "what", "where", and "how" of one development to alleviate the problem is detailed here.

The Grand Haven, Michigan, Municipal Power Plant under the supervision of Mr. J. Bryan Sims is one of the plants that has been burning heavy fuels for a long time, and successfully. One of the largest diesel power plants in the country, they have used centrifugal purification for a number of years and with their increasing oil consumption were interested in eliminating bowl cleaning. Here was our testing ground.

The Equipment

The Sharples Corporation has been conducting a long-range program aimed at more effective preparation of heavy fuel for use in diesel engines. They have worked out a system built around their recycle Nozljector centrifuge that they felt would find application where high feed rates and very high dirt content oils would greatly increase the labor requirements for their standard tubular centrifuge.

Sharples' recycle Nozljector, as shown in Fig. 1, is a disc-type machine. It has a series of tangential nozzles in the bowl shell which provide for the continuous discharge of the oil sludge. When oil is fed to the bowl, it flows down the center section, passing out under the edge of the disc stack. The feed oil flows up through the discs where clarification takes place, clarified oil discharging over the dam at the top of the bowl.

Separated solids flow to the bowl wall and discharge through the nozzles. Normally, nozzle opening is of such size that a considerable flow of sludge is maintained. In order to cut oil loss in the sludge to a minimum, the nozzle discharge is collected and pumped back into the bowl, entering at the bottom and passing through a closed system of tubes to the nozzles. This flow is outside the feed zone and does not contact the feed oil. This is a recycle system and provides for the effective concentration of the nozzle discharge into a very heavy sludge without affecting clarification efficiency of the bowl or clarity of the purified oil.

In essence, this is the system that Sharples, working in cooperation with Mr. Sims, installed at the Grand Haven plant. A test system complete with flowmeters, temperature, and flow recorders, etc., was installed to evaluate the centrifuge operating directly in the fuel oil system.

Test Operation

Hot oil from the fuel system was metered to the centrifuge. The flow rates were set for plant capacity. Thus,

while the Nozljector would have a capacity of 600 gph or more on residual fuel, the centrifuge throughput rates were held lower (300-380 gph) to within normal plant fuel consumption, due to the limited day tank capacity. Pressure data, flow measurements, as well as a continuous temperature record, was made in all streams. Samples were taken for a complete oil analysis.

The recycle system was not operated on the principle of a continuous bleed-off, but on the basis of a complete recirculation followed by periodic dumping. Some explanation of this system might be a good idea since it is somewhat unique and offers worthwhile advantages.

As shown in the layout in Fig. 2, the nozzle discharge containing oil and sludge flows from the centrifuge, dropping into the first of two recycle tanks. This upper recycle tank is normally run empty with the sludge passing through a quick-opening valve into the bottom tank. Under the control of a float-operated valve, a portion of the pump discharge recirculates back to the tank to maintain a constant level. The balance of the pump discharge flows through strainers back to the bowl's recycle circuit.

Recirculation of nozzle discharge may be maintained until the solids content increases to the point that dumping is warranted. At this time, the quick-opening valve connecting the top and bottom tanks is shut and a 3-way valve connecting the recycle pump discharge to the sludge disposal line is opened. Then, as relatively clean oil collects in the upper tank, the lower recycle tank is being emptied of the heavy sludge. The tank sizes and pump capacity are set so that the heavy sludge is removed before the upper tank is filled. The two valves are then reset and recycling resumed. This operation was carried out manually in the test setup. However, automatic controls are available for this operation.

Results and Comments

This report covers a series of tests involving runs up to 40 hr continuous operation and the processing of over 26,000 gal of oil. Tests were made on two types of feed oil available at the Grand Haven plant. Their analysis is shown in Table I. Most of the test work was made with oil "B" due to its higher dirt content. When this stock was centrifuged, it required the standard tubular centrifuge to be cleaned every three hours.

Table I Analysis of Feed Oils

Stock	A	B
° API at 60°F	22.4	22.4
Viscosity SSF 122°F	32.5	32.5
% Moisture	0.0	0.0
% Ash	0.027	0.027
% BS&W	0.1	0.3
% Asphaltenes	1.1	2.2

The foremost consideration in the test was the clarity of the purified oil. It was found that the Nozljector produced an oil having but a trace of BS&W, and an ash content of 0.01% or less. This was the equivalent of oil produced by the 16 Super Centrifuge at lower feed rates. Samples were taken over timed intervals and clarity of the effluent was found to be completely independent of the concentration of the recycled sludge.

One point deserves emphasis. When plotting instantaneous ash values at hourly periods, feed temperatures were also noted. At one point where the temperature dipped, the ash value went up. This stresses the importance of maintaining high feed temperatures when cleaning residual fuels.

Now what happened in the recycle system? The concentration of the sludge in the recycling stream built up almost as a straight line function of the feed oil gallonage handled by the centrifuge. This is shown in Fig. 3 where the BS&W values for the sludge is shown to increase as the centrifuge continues to remove more dirt. The same type of relationship was found for the ash content of the sludge as it built up from 0.03% to over 3.5%.

When the centrifuge is first put in operation, it requires a number of hours to lay down an equilibrium cake in the bowl. Once this is in place, a definite dumping cycle is maintained in which the sludge is permitted to build up to the maximum figure.

The recycle sludge was allowed to build up to a BS&W value as high as 60% and 3% to 4% ash content before dumping. Increases in each appear to be relative. It is hard to define the maximum concentra-

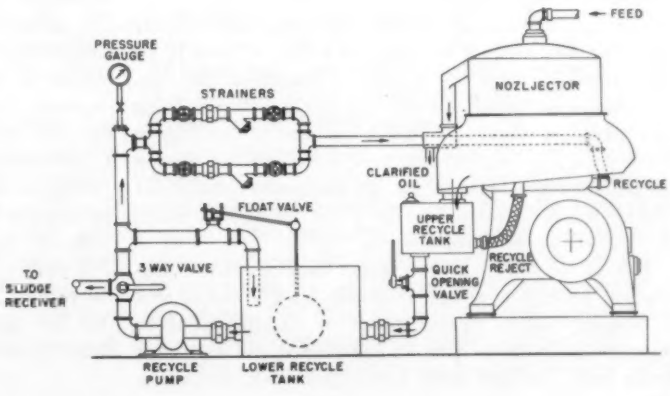


Fig. 2 Layout of recycle Nozljector system.

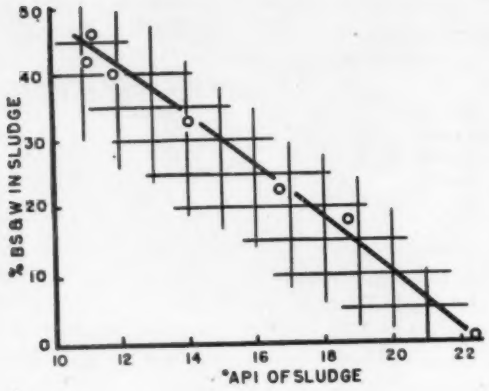


Fig. 3

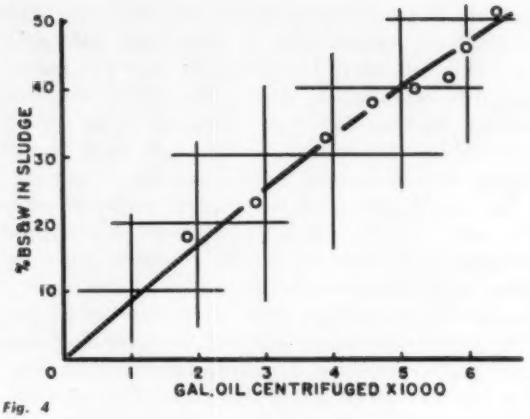


Fig. 4

tion that can be satisfactorily recycled, but on the basis of these tests it seems that a 50% BS&W value could be safely taken as an upper limit. By using a "buildup and dump" system in contrast to a continuous bleed-off, the centrifuge is operated for only a fraction of the time on very heavy sludge. Any dangers of plugging are eliminated as the recycle system is flushed out with fresh oil after each dumping. This is all done while discharging only sludge of the heaviest concentrations from the system.

A representative figure for the percentage of feed discharged as sludge, assuming an average residual fuel oil, would be about 0.4%. Closer approximation for an individual oil can be estimated by multiplying the BS&W percent of the feed oil by 1.6 or by multiplying the pounds of bowl cake collected per 100 gal of oil clarified in a solid bowl centrifuge by 0.6.

Water Recycle

In one test run a completely different system proved quite successful. By merely changing a ring dam in the injection assembly at the base of the bowl, the centrifuge was changed from a clarifier to a high capacity oil and water separator. This device permits hydrostatically balanced oil and water layers to be maintained in the bowl as in a normal separator centrifuge. Dirt is again discharged through the nozzles, this time suspended in a water stream.

Recycling is maintained with the bowl automatically rejecting any amount of water in excess of that to be discharged through the nozzles. Throughout the run, continuous sampling showed absolutely dry oil being discharged at all times. The unique use of the recycle tubes as a type of dividing cone permitted the placing of the interface between the oil and water phases far outside the disc stack so that the whole disc section would be devoted to clarifying the oil.

Use of the water as the sludge bearing phase, produces a water flow of approximately 50 gph that is sent to a skim tank to recover entrained oil, amounting to approximately 0.6%. This oil is collected and sent back to the feed. The final water discharge is dark, containing some ash and only a minor amount of hydrocarbons.

A particular application of this system would be in marine use where feed oils may be contaminated with substantial quantities of water. The centrifuge would automatically adjust to even wide variations in water content of the feed oil by accepting from the recycle system only the amount of water necessary to maintain the hydrostatic balance.

Maintenance of the System

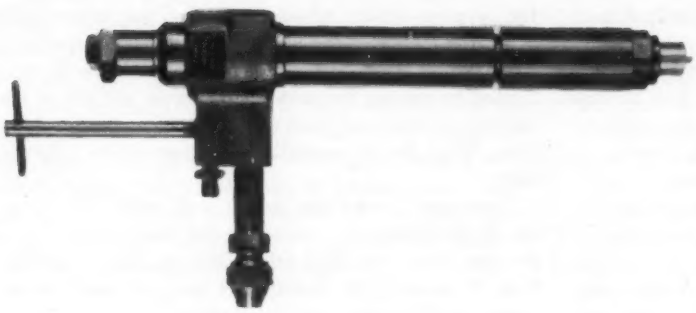
When beginning operation on a fuel, the first step is to set up the optimum dumping cycle, since too frequent dumping wastes oil while an abnormally heavy sludge would result from too long a dumping cycle. In the test work, a dumping of the tanks every 7 hr proved satisfactory. However, this will vary depending upon the feed rate and the type of oil being clarified.

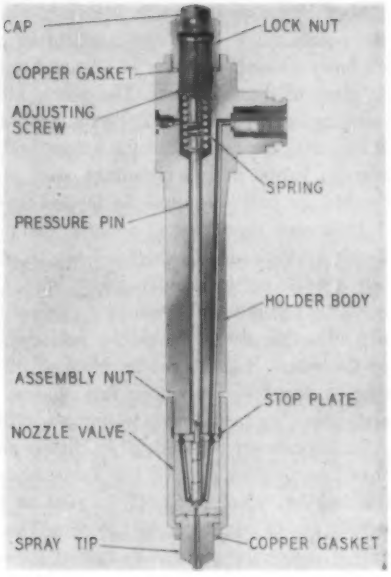
Once the proper time interval is established, it would be expected to remain constant for an extended period. Therefore only a few initial checks are required to determine the consistency of the sludge. These could be a set of BS&W analyses or much more simply, an API gravity reading with a hydrometer. As shown in Fig. 4, the API gravity of the recycle sludge is related to the BS&W content. This relationship can be determined for feed oils of various gravities.

While manual dumping of the tanks involves but the operation of two quick-acting valves, the system is readily adapted to timer operation which would make the installation completely automatic. Disposal of the waste might be a problem, although only a relatively small amount is involved. There is some evidence that it could be sold or otherwise used as a road oil or a fuel.

Maintenance of the Nozljector at this time appears to be limited to periodic mechanical inspection. The action within the bowl is such that cake builds up from a base equal to the distance between nozzles to an ever-narrowing peak. Once the sides are built up to a normal "angle of repose", this is maintained as the scouring action of the flow prevents additional deposition and carries the heavy material down the narrowing area and into the

(*Continued on page* 93)





Servicing Bendix Injectors

Recommended procedure and proper tooling for injector servicing pays off in longer life and lower servicing costs.

DIRT is the worst enemy of fuel injection equipment. For this reason, cleanliness is always stressed when discussing the care and feeding of this equipment. Cleanliness, however, does not start with the actual servicing of the injector, but long before.

Experience has shown that dirt enters the fuel injection system because of inadequate filtration or it is introduced when a nozzle or line is taken apart. Proper fuel handling and a good filter inspection schedule will help keep the fuel clean. Proper servicing procedure will prevent dirt contamination.

Injectors will have to be serviced periodically. This usually means pulling the injectors, cleaning exterior surfaces, and checking such things as popping pressure, spray pattern, dribble, and chatter.

But before you break that line, clean off all the dirt around the fitting. This goes for the injector too. Caps, plugs, and/or masking tape are used to close all openings. After external deposits such as craters and flags are removed, the nozzle should be polished. This will help keep deposits from forming and also ease their removal the next time, since they do not readily adhere to a smooth surface.

Don't take the injector apart unless the tests show that work is needed. If it passes the tests, you are wasting time taking it apart and giving dirt another chance to get inside.

If the injector didn't prove out, the preliminary popping test should have given you some good clues as to what ails it. Here again cleanliness pays off. You are dealing with finely matched parts and surfaces where a burr or tiny particle of dirt makes the difference between go and no-go.

Cleaning

Containers with clean fuel oil, Stoddard's solvent, or kerosene should be reserved for cleaning injector parts. If washing containers are provided with a wire screen, raised from the bottom of the container, sediment will be permitted to fall away from the part and its agitation prevented.

In many cases, a thorough cleaning of the faulty injector will remove any loose sediment which has prevented the needle seat from sealing against the nozzle body seat. Follow this with the application of clean, dry compressed air and the operation is complete. The injector should then respond favorably to a popping test.

Where an injector has operated for a prolonged period with dirt in the valve seat area, a light seat honing operation may be necessary if a leak-free seal is to be obtained. This comes later.

Needle Sticking?

Binding of the needle in the bore can be due to several conditions. It can be due to sediment caught between the needle and bore, improper torquing of injector hold-down bolts, distortion from excessive heat, or lacquer forming on the lapped surfaces.

Lacquer may not be visible, but can be detected by rotating a dry needle in a paper towel. If lacquer is present, a squeaky noise will be heard. Removal of the lacquer, which incidentally is formed by the breakdown of certain fuels when heated sufficiently, can be accomplished by the use of solvents or polishing. For polishing, a very fine rouge is used. (Scintilla Green Rouge No. 11-5307 is recommended by the manufacturer.)

If the needle is stuck in the body, it can best be re-

moved by using hydraulic pressure. For this operation, the nozzle valve should be installed in a modified holder body assembly which has been fitted with a spacer in place of the stop plate. The center hole of this spacer must be large enough to allow the needle to pass through it into the center cavity of the holder body. Such a spacer can be made from a standard stop plate, thereby retaining the fuel holes and the lapped surfaces.

It is also necessary to remove the pressure pin and nozzle spring from the holder body to provide space for the needle in the holder body bore. To prevent the needle, when released, from flying out of the holder body, the adjusting screw should be replaced. The lower end of the nozzle valve must be blanked off with a ground disc to direct high-pressure fuel against the needle. Use a standard pop-test device to pump out the needle.

In the case of the Bendix NCS-type nozzle, which has spray orifices as part of the valve body, a special extracting nut (No. 11-5284) is used in place of the assembly nut to remove a stuck needle. The operation, however, remains the same as described above.

Note: When handling disassembled injectors, it is important that the needle and nozzle bodies be kept together as pairs. They are mated parts and must not be intermixed.

Testing

Take a look at the equipment first. The nozzle tester should be provided with a micronic filter between the fuel tank and the pump. Good practice calls for the use of clean fuel in the tank each time rather than the reuse of fuel which may have picked up dust or sediment during use.

Tight fittings throughout the testing setup will prevent false pressure readings and a periodic check of the pressure gauge will insure its accuracy. After mounting the injector in the test fixture, the pump should be stroked several times with the opening pressure set at zero. This will serve to flush out the nozzle valve. Opening pressure should then be adjusted to that prescribed by the engine manufacturer, and the injector tested for popping action. About 30 strokes per minute will prove the ability of the nozzle valve to pop properly.

A leakage test to determine the seat seal can be performed by raising the pressure to within 100 psi of the opening pressure and observing the orifice area for dribbling. Wipe the tip carefully to be sure of an accurate test.

Clearance between the needle and valve body bore can be determined by measuring the time elapsed for a pressure drop from 3500 psi to 2500 psi. If it takes less than 12 seconds, the clearance is too great and the injector should receive factory servicing.

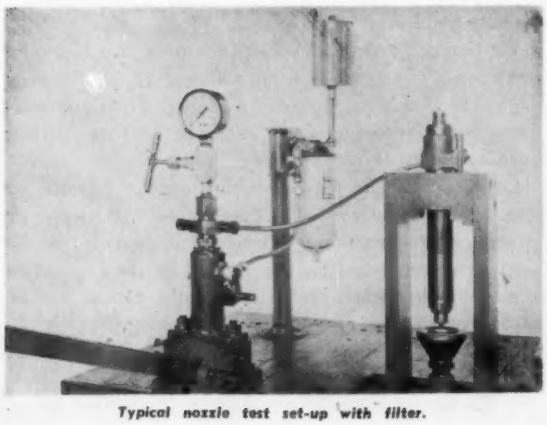
Seat Honing

Ridges and other deformation of the seat in the nozzle body can be removed by rehoning the seat. The shank of the mandrel used must fit the bore of the body with not more than .0003-in clearance on the diameter in order to assure concentricity of the rehoned seat with the needle bore.

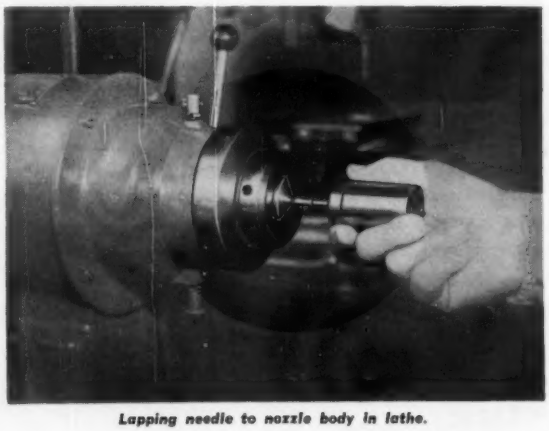
Select a mandrel of the same diameter as the needle, within .005 in. Use a good micrometer with .0001-in graduations. The honing point of the stone must be dressed to 89 deg, plus or minus 10 min included angle. Honing stones are sent out from the factory very accurately dressed to this angle and should be returned for redressing when worn.

Chuck the mandrel in the proper collet in the bench lathe and see that it runs true. A little lard oil or similar lubricant applied to the abrasive surface of the stone will insure best results. The shank should also be lubricated to prevent damage to the lapped hole in the nozzle body.

Rotate the mandrel at 1750 to 3450 rpm and hold nozzle body by hand. Lower speed may be used, but more time will be required. With the hone stopped, put the body over the hone until the stone contacts the body seat. Start the lathe and bring pressure against the body seat. Release pressure after about 5 to 10 sec, and slowly rotate the body before again applying pressure.



Typical nozzle test set-up with filter.



Lapping needle to nozzle body in lathe.

Nozzles only slightly worn may require only a light honing. Nozzles considerably worn require more. After honing a few times, inspect the seat visually with the otoscope. Hone until the seat is thoroughly refinished.

Before lapping the needle to the body, remove any burr or fins from the top end of the needle large diameter with a fine stone while rotating the needle on a spindle. Keep the needle clean to preserve the lapped surface by wrapping with paper such as clean paper towel. Also stone the upper end surface of the needle if there are any irregularities or roughness.

Lapping

After honing the body seat, lap needle and body together at a maximum speed of 1750 rpm. Hold the small diameter of the needle in a collet or chuck, projecting out far enough to prevent the end face of the nozzle body from contacting the chuck. Keep the end of the nozzle body at least 1/16-in from the chuck at all times.

Apply a little fine rouge (No. 11-5307) to the needle diameter and with the lathe stopped, fit the body over the needle. Before starting the lathe, rotate the body on the needle a few times with an oscillating back- and-forth stroke. If the body rotates freely, start the lathe and continue the back-and-forth motion until the body loosens slightly on the needle.

Thoroughly wash the parts, apply light oil. and test in a pop tester. If the nozzle valve does not respond sharply or if it leaks, apply a small amount of a coarse rouge (Scintilla recommends yellow lapping rough No. 11-5325) to the angular seat of the needle only and lap lightly to the body seat. *Be extremely careful to avoid getting yellow rouge on the cylindrical surfaces.*

Flat Lapping

Any scratches or mutilations on the flat end faces of the nozzle body should be lapped on a flat lapping plate. Be careful to see that these surfaces are lapped parallel.

Thoroughly wash the nozzle body and needle in a suitable cleaning solution—Stoddards solvent, white kerosene, or fuel oil—to remove traces of lapping compound. Use a light oil such as SAE No. 10 to coat all surfaces to prevent rusting.

Summary

In winding it up, there are a few points to be stressed. First, the nozzle valve is extremely sensitive to dirt and is sometimes quite difficult to wash properly. This means you will have to be sure that the final washing solution is absolutely clean and changed frequently.

The spray tip has not been mentioned except for the external cleaning. Recommendations for its care include boiling it in solvent to help loosen hard deposits in the orifices. Bendix also recommends that when more than half the orifices become oversized by more than 0.0004-in, the spray tips should be discarded.

The final thought is a good one to remember. Injection equipment presents no great mystery as far as servicing goes, but in order to service and maintain this equipment properly, strict attention must be paid to cleanliness, care of tools, and the manufacturers recommendations.

Flat lapping plate

Holes enlarged

Properly cleaned

Equipment needed for Repairing Nozzle Valves

1. A bench lathe, preferably Shauer type, with accurate collets of proper size to hold nozzle valve needles by the pressure pin end.

Nozzle Valve Size	Collet Size
NB	7/64"
NC	9/64"
ND	5/32"

2. Scintilla No. 11-5307 green lapping rouge and No. 11-5325 yellow lapping rouge.
3. Pencil honing stones.

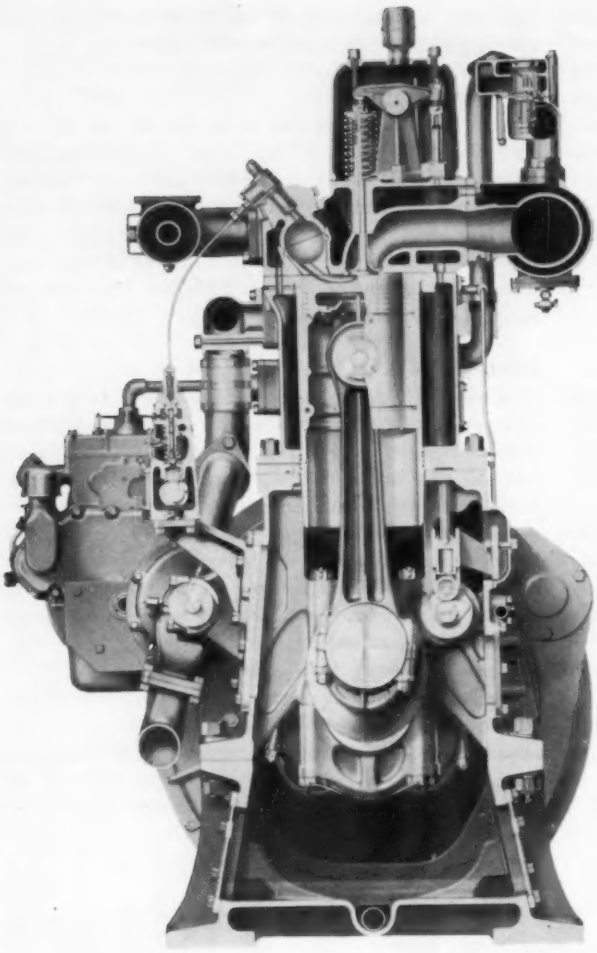
For Nozzle Valve	Part Number
NB	11-5334
NC	11-5290
ND	11-5291

Each set consists of six stones, mounted on mandrels, with diameter accurately increasing in steps of approximately .0003 in.

4. An otoscope, battery style, for inspecting seats in nozzle valve bodies.
5. A two- to five-power magnifying lens for inspecting needle seats.
6. Flat lapping plate.

Pencil honing stones for refinishing nozzle seat.

Otoscope for visual inspection of nozzle body seat.



Cutaway view of the Waukesha Model LRD engine.

Tuneup and Overhaul Data for Waukeshas Models LRD and LRDS

THESE Waukesha Models are designed and constructed for heavy-duty application. Diesel versions feature the unique Waukesha combustion chamber. Conversion for natural gas operation is made by the use of a special kit. Changes consist of switching cylinder heads, plus the addition of magnetos and a gas carburetor. Kits are complete including directions for the conversions. Data given pertains to the diesel versions.

Basic Engine Data

Information listed here is general with some specific data necessary for tuneup. Overhaul data is given later.

Bore and Stroke — 8½ by 8½ in
Compression Ratio — 15 to 1
Oil Capacity (engine) — 72 qt
Injection Pump Lube — 1¼ pt
(Engine or Hydra-Matic oil)
(discussion follows)

Injection Pump Timing — 17 deg BTC
Firing Order — 153624
Displacement — 2894 cu in
Comp. Pressure — 350-400 psi (cranking speed)
Filter Cap. — 11 gal (Honan Crane)
— 5½ gal (Winslow Full-Flow)
Oil Pressure — 40 psi, hot, at governed speed.
Minimum — 25 psi low idle (approx. 450 rpm)
Nozzle Pressure — 1800 psi

Valve Clearances	Intake	Exhaust
Cold	0.025	0.035
Hot	0.008	0.007

Note: Valves should be set cold.

Tuneup

A tuneup here will be considered as an intermediate step between routine servicing and overhaul. It will consist of those jobs that can be done without removal of major components. It serves two purposes: minor work and adjustment will restore engine operation to maximum efficiency; and secondly, alertly performed, it will detect conditions that could lead to more serious trouble.

Since tuneup entails inspection, start with a clean engine. Solvent cleaning, steam stripping, any method that is effective should be used to get down to clean metal. You can see better and it helps to keep dirt out of the engine.

The work will be discussed system by system, giving specific details on how to do certain jobs and outlining checks to be made.

Lube Oil System

Drain the oil and change the filters at the time of tuneup. Remove and clean the screen mesh strainers below the oil level equalizers in the oil sump. Soak screens in a solvent such as benzol or lacquer thinner to soften deposits for removal without damage to the screen. Check sump for sludge accumulations. A bad condition might indicate need for an oil cooler check, filter check, or even suitability of the oil being used.

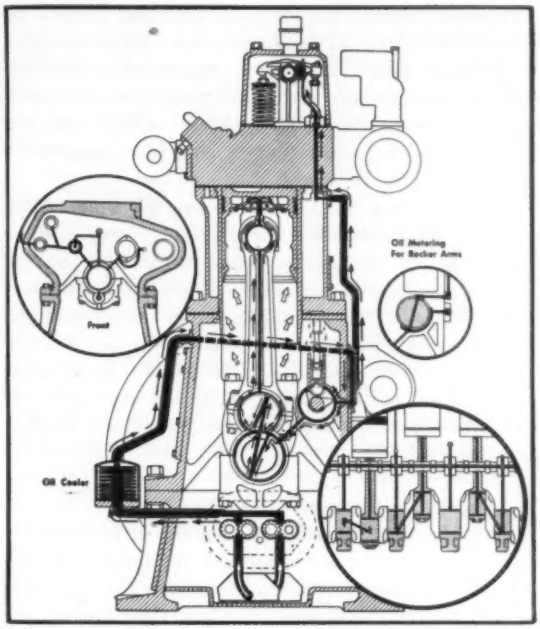
Ordinarily the oil cooler should be removed, disassembled, and cleaned every 500 hours. Rust and lime deposits should be removed from the water side. Oil passages in the plates should be cleaned by pumping commercial carbon and sludge remover, benzol or lacquer thinner through them. *This should be done as soon as possible after removal of the unit from service.* Check the cooler bypass valve operation. Its only purpose is to bypass cold oil when starting. It is factory-set to about 5 psi differential between inlet and outlet and no adjustment should be made.

Examine the filter elements for excessive sludging or "plastering". Blocked filters are often indicated by a cold case, showing that no oil is going through. Higher than normal oil pressure at filter inlet also indicates plugging. Be sure bypass valves are operative.

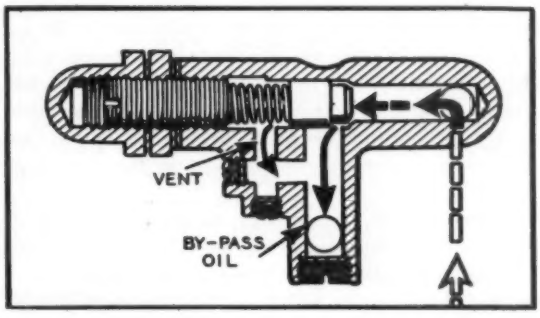
Refill the system with the proper viscosity oil. This can be determined two ways, based on oil temperature or air temperature. In the first method, measure the oil temperature in the crankcase by an accurate temperature gauge immersed in the oil. Make check runs under actual speed and load conditions using SAE No. 40 oil as a starter. Select the viscosity from the table below. The air temperature selection chart, also given, is an approximation subject to judgment in border-line cases.

Oil Temp.	SAE No.	Ambient Temp.	SAE No.
210-230°F	50	70-90°F	50
190-210°F	40	50-70°F	40
155-190°F	30	30-50°F	30
130-155°F	20W	Below 30°F	20W

A heavy-duty oil with the characteristics of Mil-L-2104A (API service designation DG) should be used.



Lubrication system for Model 6-LRD engine. Enlarged view of pressure relief valve is shown below.



With fuels having over 0.5% sulfur, Supplemental List 2 (API's DS) oil should be used.

Oil pressure is regulated at the pressure relief valve located on the pump cover (lower front of engine). Fluctuating or abnormal pressures, either high or low, with the engine hot at governed speed are trouble signals. Such observations are only valid with new oil and the rest of the system in good condition. Do not readjust the pressure-relief valve to compensate for diluted or badly contaminated oil. Adjustment is seldom necessary.

If satisfied that some work is necessary, remove the adjusting screw and spring. Check the valve for free movement. Foreign material may have jammed the valve or clogged the vent passage behind the valve. Clean thoroughly. Burrs or nicks on seating faces should be carefully stoned and polished with crocus cloth dipped in fuel oil. Replace and adjust the valve.

Drain and replace the oil in the injection pump base. Clean Hydra-Matic oil should be used wherever possible as an extra protection against condensation moisture. Fuel oil leakage from barrel and plunger assemblies is the normal lubricant and a mixture of fuel with the lubricating oil is normal. Proper level is maintained by an overflow line. Be sure that this is open.

Check greasing too. Two cups on the water pump should be filled with water-pump grease. Normally these cups should be turned every eight hours. See that this has been done and that the cups are not full of hardened grease. Cups on the tachometer drive takeoff and the starter Bendix outer bearings and steady-rest bearing should get a good grade of cup grease. If a fan is used, once a month the screw plug in the hub should be replaced with a cup and a good amount of ball bearing grease applied.

Fuel Injection System

Check the fuel system right from the tank to the injection pump. Drain any condensate or sludge from the tank. Drain and clean the strainer. Clean the filter casing and replace the element. The gear-type fuel supply pump will need little if any attention if the fuel is kept clean.

These engines generally have pyrometers and readings will have indicated temperature unbalance among cylinders. This could be due to faulty nozzles and/or the injection pump. It might also be due to compression leaks. The nozzles should be removed for inspection and test anyway, so at that time compression tests can be made using a compression gauge at the injector holes. This will confirm or reject compression as the source of trouble.

In removing nozzles, protect all disconnected lines, the injector openings, and the head hole by shipping caps and/or masking tape. Nozzles, after long service, may need some tapping with a soft-face hammer to loosen them in the holes. Take it easy; the nozzle is a piece of precision equipment. Don't attempt repair or adjustment without adequate equipment and skills. The very least is a good nozzle tester. Otherwise, replacement is the best answer. Then send the nozzle out for servicing.

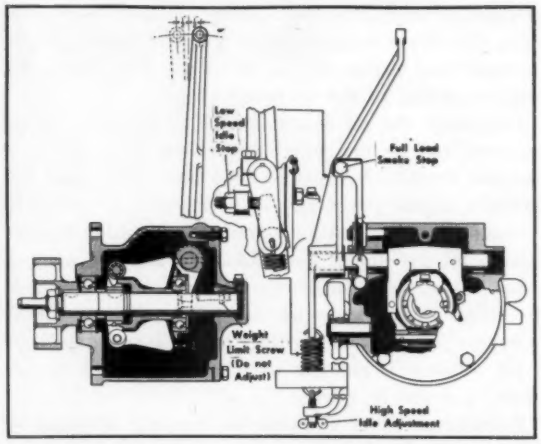
With proper compression and good nozzles, failure to run smoothly can be pinned on the pump. Comments regarding nozzles go double here. Don't tinker with the injection pump; have it serviced unless you are all set up for the job. If the pump is removed and replaced, it must be timed accurately.

Bar over the engine until No. 1 cylinder (furthest from flywheel) is on the *compression* stroke. (Both valves should be closed and pressure building up in the cylinder.) Bring up in direction of rotation (never back off) until the mark "F.P." on the flywheel is centered in the flywheel opening. The engine is now set.

Rotate the coupling member on the pump until its timing mark indexes with the one on the pump housing. Note that the coupling mark is set for that particular pump; never change the coupling without having the pump re-timed and the coupling re-marked. Locate the pump on the bracket using the dowels and turn hold-down bolts finger-tight. Realign marks accurately and hold while installing cap screws in the two opposite coupling holes found to be in alignment.

There should be a minimum of 0.010-in (usually about 0.030-in) clearance between the coupling ends and discs. This should be measured by feeler gauge at four points. Tighten the hold-down bolts and re-check both this clearance and index of timing marks.

Next, check governor settings. Holding governor lever to extreme right (toward front of engine), locate full-load smoke stop out of contact with the lever. This establishes total range of pump rack travel. Adjust the control rack linkage to provide 1 25/32-in rack extension from the end of the rod to the face of the pump. Holding the lever in this position, adjust the smoke stop until the pump rack extension is exactly 1¾-in. This adjustment is important and should be made accurately with a machinist's steel rule or precision depth gauge. Tighten locknuts securely and recheck seating. Be sure that there is no appreciable play, or at the other extreme, any tendency to bind in linkage and pins.



Sectional view of the variable-speed, flyweight governor. Adjustments in the field are not recommended unless supervised by factory man.

Relax tension on the governor spring adjustment screw. The engine will probably run slower than the desired high idle, but this prevents overspeeding during adjustments. Start and warm up the engine to normal temperature. Readjust the high idle speed by increasing the spring tension. The governor lever will be riding against the high idle stop. Tighten the locknut securely. Adjust and lock the low speed idle stop with the engine running at a minimum of 450 rpm.

Don't try to adjust the surge or bumper spring screw. It is provided for manufacturing reasons and in this case limits the travel of the governor weight to prevent internal damage.

Best operational results are obtained by the use of fuels within the following specifications.

Viscosity, SSU, 100°F	30-50 seconds
Residue, Open Cup Combustion	2% maximum
Sulfur	0.7% maximum
Water and Sediment	0.5% maximum
Cetane	45 minimum
Cold Test	0°F*

*Or at least 10°F below lowest temperature surrounding engine.

Cooling System

If clean water, properly inhibited, has been used there is little to do to the cooling system. A mild cleaning is all that is normally required. A solution of washing soda will generally do the job. Drain the system and measure the volume. Refill with fresh water to the extent of half this volume. The other half should be boiled, adding washing soda until no more will dissolve. Fill up the system with this solution and run the engine normally for 24 hours. Drain, flush, and refill, adding soluble oil in the proportion of one ounce per gallon of water.

Other inhibitors may be used, in which case follow the manufacturer's instructions carefully. Also, many excellent commercial cleaners are available. Just be sure that they have no reaction with copper or bronze in the engine and always follow instructions carefully.

While the engine is drained, check the thermostats. Normally these give no trouble but should be checked from time to time. Four thermostats are located in the control housing. Test by suspending both a thermostat and a good thermometer in a bucket of water that is being heated. They should start to open at 160°F to 165°F and should be fully opened at 185°F to 190°F. Seat them squarely when reinstalling them.

When the engine is refilled and up to temperature, check the "tell-tale" holes on the side of the engine opposite the camshaft. These holes connect to an annular groove in the cylinder sleeves between the two lower seal rings. Leakage of coolant by the upper two seals will show up here and is an indication that work must be done on the liners.

If the engine uses a fan, check the blades for runout and pitch. Either condition can cause considerable vibration. Fan belt condition and tension should be checked. Belts should deflect one inch midway between the pulleys. Never replace only one belt.

Valve Clearances

Before valve clearance adjustment, make sure that the tappets actuating the valves involved are riding the cam's base circle. This is the case when each cylinder is on its compression stroke. To save work in barring over the engine, check the valves of cylinders in accordance with the firing order. Clearances specified in the table and on the engine's name plate are for engines at normal room temperature—not for hot engines.

When checking clearances, note the condition at the rocker arm and valve tip. Rocker arms should contact valve tips evenly and should not be worn hollow. If satisfactory, loosen the locknut and with the proper feeler gauge between arm and valve tip, set the adjusting screw to produce a light drag. Tighten the locknut and recheck.

Overhaul Data

Upon completion of the type of inspection just covered, the engine should be in top condition—or you may have found that more detailed work was required. As you get into the heavier work, it must be assumed that you have the tools and the background of mechanical practices necessary. If not, the job should be farmed out to someone who can handle it properly.

Therefore, all that will be given here are the basic specifications—those vital references for even the most experienced—so that the job can be checked out right. They will be in tabular form for ready reference and not placed in any order signifying a sequence of operations.

Torque Recommendations in Inch-Pounds (for ft-lb, divide by 12)

	Cyl. Heads	*Mains*	*Rod Caps*	*Flywheel*	*Comb. Caps*
Torque	3500-3600	3500-3600	2000-2100	1450-1500	1000-1150
Size	⅞"-14	⅞"-14	⅝"-18	⅝"-18	½"-20

Pistons (aluminum)

Pistons are removed from top and have two 5/16"-18 puller grip holes. Piston weights (without pin and retainers) are stamped on pistons. Permissible weight variation is 8 oz. Clearances to bore are:

Top Land	*2nd & 3rd Land*	*4th & 5th Land*	*Skirt Bottom**
0.060-0.064	0.051-0.055	0.043-0.047	0.13

*Measure with ½" wide feeler stock near bottom (least worn) part of sleeve, 90 deg from pin axis. Use three 0.003" and one 0.004" feelers. Should pull out with 4- to 8-lb pull.

Other Dimensions

Center of pin to piston top ..... 6.159"-6.156"
Piston crown to cylinder head ..... 0.050"-0.100"
Top of piston block face (not sleeve) ..... 0.025"

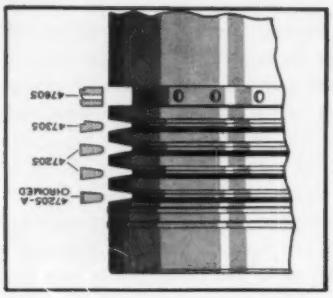
Pistons (and Sleeves) have letter markings denoting sizes. Classification is as follows:

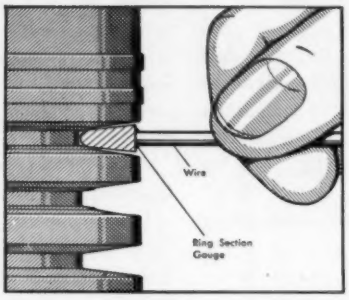
Letter Mark	*Am't Oversize*
A	Standard
B	0.0005"
C	0.001"
D	0.0015"

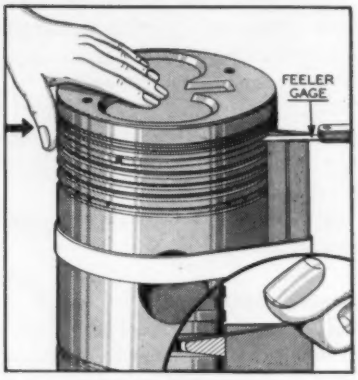
Pins and pin bosses have color markings. Matching colors should hand push fit at room temperature. Markings are

Color	*Size Range*
Red	0.0001-0.0002 under
White	Standard
Blue	Standard to 0.0001 over

For best results, letter markings of pistons and sleeves, color marking of pins and pin bosses, and piston weights should all be matched. Ordering from factory in assemblies reduces inventory required.







From left to right are: piston ring setup; method of checking ring groove for wear; and method of checking ring side clearance.

Piston Rings

Top ring is wedge-shaped with chromed face; 2nd and 3rd rings are wedge-shaped; 4th ring is wedge-shaped but notched (bottom) as a scraper; 5th ring is rectangular, double-scraper vented oil ring.

Ring No.	*Ring Gap*	*Max. Width*
1	0.050″-0.070″	0.181″-0.182″
2 & 3	0.050″-0.070″	0.181″-0.182″
4	0.050″-0.070″	***
5	0.030″-0.040″	0.310″-0.311″

***Theoretically same as 1, 2, and 3, but notched so exact measurement is difficult.

For quick check of groove wear use section of new ring as plug gauge. Hold against strong light. If wear appears limited, check with feeler gauge as illustrated. New piston and rings—0.004″ feeler in top three ring grooves, 0.003″ feeler in 4th groove.

Connecting Rods

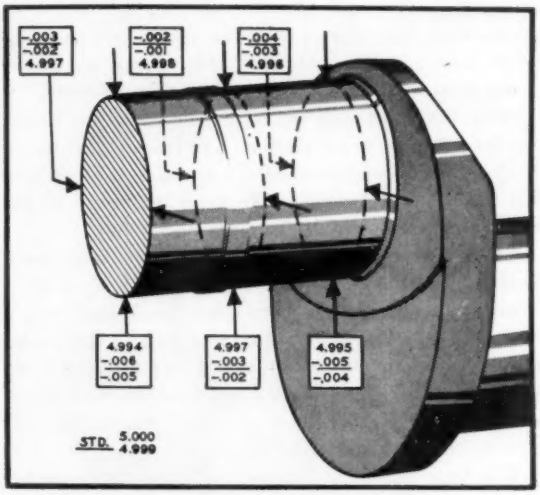
Rods have precision-type, steel-backed, tri-metal bearings in big end. No adjustment—replace. Small end has two bushings in the bore, assembled with ends of grooves inward, and diamond-bored. Bearing center-to-center distance is 21.373″-21.377″.

Big-end bore ..... 5.437″-5.438″
Big-end running clearance ..... 0.0026″-0.006″ (max)
Side clearance ..... 0.060″-0.064″
Crush ..... 0.0015″-0.0025″ in 5.438″ bore
Piston pin running clearance ..... 0.0015″-0.0024″
Piston pin diameter ..... 2.9996″-3.0000″
Bushing press fit 0.0035″-0.0065″ in 3.250″-3.251″ hole

Crankshaft and Mains

Main bearings are also precision-type, steel-backed, tri-metal bearings that are replaced when worn beyond limits.

Running clearance ..... 0.003″-0.0065″ (max)
Crush ..... 0.0025″-0.0035″ in 5.938″ bore



Typical worn dimensions of a crankpin showing points at which measurements are made.

End play ..... 0.008″-0.012″
(shim-adjusted at front thrust plate)
Journal diameter (standard) is 5.500″-5.499″
Crank pin diameter (standard) is 5.000″-4.999″

Mike each pin and journal at both ends and at center on two diameters, 90-deg apart, for out-of-round, taper, grooves, and ridges. Typical worn dimensions are illustrated. When running clearances on pins or journals exceed indicated maximums, replace bearings. If pin or journal condition is bad and out-of-round or taper exceeds 0.003″, regrind shaft. Bearings are available in 0.020″ and 0.040″ oversizes.

Cylinder Sleeves

Note marking data under "Pistons". Clearances and sleeve protrusion must be checked.

Clearance, seal ring area to block bore .... 0.004″-0.008″
Top flange diameter to block counterbore 0.007″-0.012″
Sleeve flange protrusion above deck ..... 0.003″-0.007″

Cylinder sleeve protrusion above cylinder block should measure between 0.003-in and 0.007-in when measured as shown.

Camshaft and Bushings

Inspect fastenings and alignment of two halves of shaft. Mike journals and inspect cam lobes for wear, spalling, pitting, scuffing, etc. Unless they can be corrected by light honing or polishing, replace.

Badly worn bushings must be pressed out and new ones pressed in. In addition to press, they are held by bronze dowels. Dowels can be sheared during removal. Line up oil holes before pressing in new bushing. Open up dowel holes with No. 14 drill through old dowel. Replace with 3/16″ bronze dowel. Align-bore for proper clearance.

Running clearance, all journals ..... 0.004″-0.005″
End clearance ..... 0.006″-0.008″

Valve Mechanism

Always set valves at normal room temperature with cold settings previously given. Use "Hot" settings only in emergency.

Valves

	Head Diam.	*Seat Angle*	*Seat Width*	*Stem Diam.*
Intake	3 3/4″	30°	5/32″	0.6815″-0.6805″
Exhaust	3 1/16″	45°	11/64″	0.6815″-0.6805″

Faces—Stellite #6

Guides

	Length	*Reamed Hole Size*
Intake	6 5/8″	0.6875″-0.0005″
Exhaust	6 5/8″	0.6875″-0.0005″

Exhaust Valve Inserts

	Standard	*1/32″ Over*	*1/16″ Over*	*3/32″ Over*
Insert OD	3.130-3.131	3.161-3.162	3.1925-3.1935	3.224-3.225
Cntrbore ID	3.124-3-125	3.155-3.156	3.1865-3.1875	3.218-3.219
Cntrbore Depth	0.385-0.390	0.385-0.390	0.385 -0.390	0.385-0.390

Intake Valve Inserts

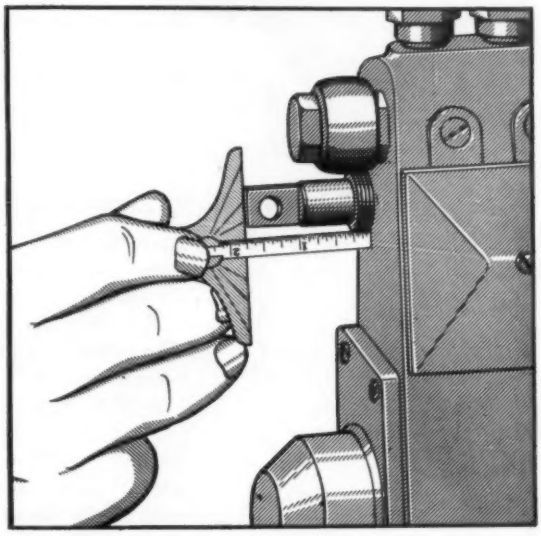
	Standard	*1/32″ Over*
Insert OD	3.8175-3.8185	3.8485-3.8495
Cntrbore ID	3.8115-3.8125	3.8425-3.9435
Cntrbore Depth	0.385 -0.390	0.385 -0.390

All inserts are Stellite #3. They are peened in head after shrink installation of insert. Cutter, piloted in guide bore, must be used to carefully cut away lip before insert removal. New inserts, after chilling, must be driven in squarely and re-peened.

Flywheel and Housing

For best alignment of driven equipment, flywheel and housing runout should be checked. Figures indicate total indicator reading.

Flywheel pilot bearing, maximum total ..... 0.005″
Face runout, 24″ to 30″ wheels, maximum total 0.012″
Face runout, 30″ and oversize, maximum total .... 0.015″
Housing bore, maximum total ..... 0.015″
Housing face, maximum total ..... 0.010″



Method of measuring fuel pump rack extension.

Injection Pump Data (No. 60334 pump)

Rack extensions from end of rack to pump face for different conditions are given.

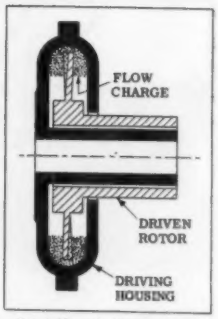
Low idle, 600 rpm ..... 2 1/8″
High idle, 980 rpm ..... 2 9/64″
Full load, 900 rpm ..... 1 25/32″
Smoke stop adjustment, average running ..... 1 3/4″

Calibration data is given for two points in pump speed range.

Low Idle—Pump speed of 300 rpm with rack setting of 0.250″-0.010″ from Full-Off position. Delivery should be 31-32 cc per 250 strokes. Equalize within 1 cc in large graduate.

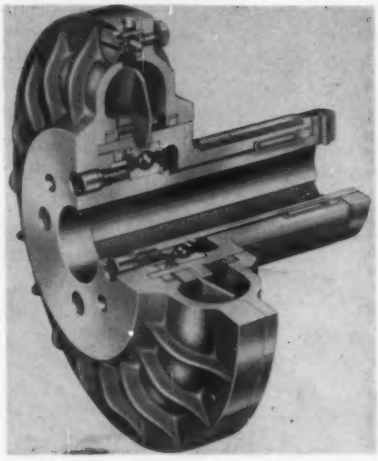
High Idle—Pump speed of 450 rpm with rack setting of 0.560″-0.010″ from Full-Off position. Delivery should be 128-132 cc per 250 strokes. Equalize within 5 cc in large graduate.

This data can only be applied when the pump is under test on a suitable calibration stand.



Centrifugal force of the rotating housing throws the flow charge outward and causes wedging action between housing and rotor.

Cutaway of the "Flexidyne" below shows construction. Special screw at top allows charge to be altered rapidly, should a change in torque be necessary.



Dry "Fluid" Drive

Operating on a different principle, the "Flexidyne" is similar to a fluid coupling.

POWDER instead of oil transmits power in the "Flexidyne". It has some advantages similar to a hydraulic coupling plus a few unique characteristics of its own. It is designed to handle difficult starting and reversing problems by permitting the motor to come up to speed before picking up the load. Shock load and overload protection are also featured.

Originally the principle was developed in Europe where thousands of installations have already been made. Now, the Dodge Manufacturing Corporation has redesigned the unit to American standards and is marketing it through its distributors.

The Flexidyne Drive consists of a housing, inside of which a rotor is free to turn concentrically. Between the two are fine particles of spherical steel shot called the "flow charge", which acts very much like a fluid. It is the flow charge which transmits power from the housing to the rotor. This flow charge is easy to seal in, has a high density, and can stand relatively high temperatures.

How It Works

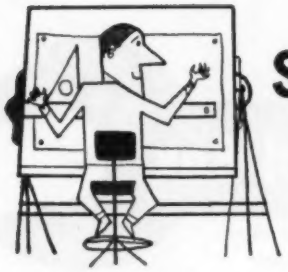
The motor is connected to the housing and starts it turning at no load. The flow charge is thrown to the circumference of the housing, is compressed by centrifugal force, and revolves with the housing.

The friction and wedging action of the revolving flow charge starts and accelerates the rotor which is connected to the load. Rotor and housing reach identical speeds and operate with zero slippage between motor and load at normal running speeds.

In case of an overload, before damage is caused, the rotor slips relative to the housing, overcoming the friction and wedging action of the flow charge. A thermal switch which automatically cuts the electrical circuit if an overload persists, is available as optional equipment.

The amount of flow charge determines the torque capacity. Because it is easy to vary the amount of this charge, the exact starting torque needed for anything from the smoothest to the fastest start can be obtained.

Aside from low first cost, low maintenance and good efficiency, it should permit the use of smaller, lower cost motors and controls, with greatly reduced current demands and improved power factor. Its smoother starts and gentler overload protection help to avoid breakage and reduce maintenance on drives, gears, bearings, and driven machinery.



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

MACK—Injection Nozzles—END-673 Engine . . .

Generally speaking, Mack says leave the nozzles alone if the engine is operating well. Disturbing them only invites trouble. Any signs of miss or loss of power suggests a nozzle check, but this should be done only after all other conditions have been found to be correct.

Where necessary, cleaning and setting at the end of the 4000-mi guarantee period will eliminate any initial dirt in the units and the setting will take care of any settlement of the spring. After that, nozzles should be left alone as long as the engine performs properly. When between 50,000 and 75,000 mi have elapsed, Mack recommends another, especially if any loss of power is evident.

When checking nozzles be sure to follow these instructions:

1. Practice extreme cleanliness.
2. Clean head, especially around nozzle holders before removing nozzle.
3. Use protective caps, plugs, or tape to close off lines, etc.
4. Test nozzle for leakage, opening pressure, and spray pattern. Nozzle should open between 2300 and 2350 psi. Check pattern for four equal-length sprays having no coarse stringers. Usually the popping test will furnish some clues as to what is ailing the nozzle. Before disassembling the nozzles, the proper tools should be available because without them, the nozzle cannot be assembled or adjusted correctly.

CAUTION—Loosen all nozzle spring tension before disassembling nozzle or dowels may become bent. When reassembling, grease spring retaining capnut threads.

5. If necessary, clean spray holes with special cleaning needle 17-T-11099 in vise 17-T-11100. Practice extreme care so as not to break off needle in hole.
6. Ream carbon from nozzle holder port with tool 17-T-11103. Use reamer lightly, just enough to remove carbon. Be sure to use special brush 17-T-11104 to clean inner bore.
7. Torque nozzle capnut with centering sleeve 17-T-11104 to 35-40 ft lb before resetting nozzle opening pressure.

A most common abuse is the attempt to seat valve in nozzle body by lapping and even grinding compound. Usually compound works around the pin and scores both pin and inside of body. Another abuse is cleaning outside of nozzle body, particularly the end, on a coarse revolving wire brush. Recommendation: Valve and body are finished to slightly different angles, another reason why valve cannot be used to lap body seat. Polishing tallow 17-T-1790 should be used to clean nozzle internally. If this does not suffice, take to an authorized American Bosch service station for repairs.

EMD—Increased Piston Assembly Life—567 Engines . . . .

Recent engineering tests indicate that 0.005-in more wear can now be allowed on "B"-type piston assembly thrust washer 8081272. This will prolong the life of these assemblies, reducing overall maintenance costs. The changes in the piston assembly limit readings affected by this change are as follows:

	Old Limit	New Limit
Thrust washer thickness	.055	.050
Snap ring to piston carrier clearance	.025	.030
Compression lead reading increase from new to removal limit	.025	.030

The new figures will be incorporated in next revision of the 567 Manual.

INTERNATIONAL HARVESTER—Checking Torque Wrenches . . . .

To make sure you are obtaining correct readings with your torque wrenches, a check may easily be made by the following method:

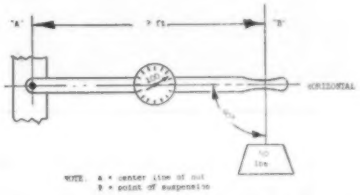
Wrenches should be checked within ranges where they are normally used. 1. Hang torque wrench on a fixed nut as shown in sketch.
2. Set indicator to "0". (This will compensate for the wrench weight.
3. Hang a known weight from the wrench at any known distance from center of nut as shown. Wrench must be in a horizontal position and the weight should be suspended from a small locating notch on the handle.
4. Weight (in pounds) times distance AB (in feet)=foot pounds torque, and should agree with indicator reading.

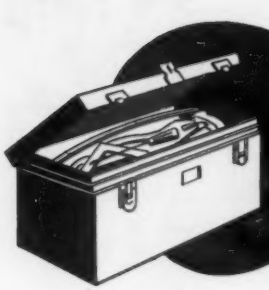
Example shown:

Weight X Distance =Torque

50 LB X 2 Ft= Foot Pounds

Remember that any weight or distance can be used and substituted in the formula.





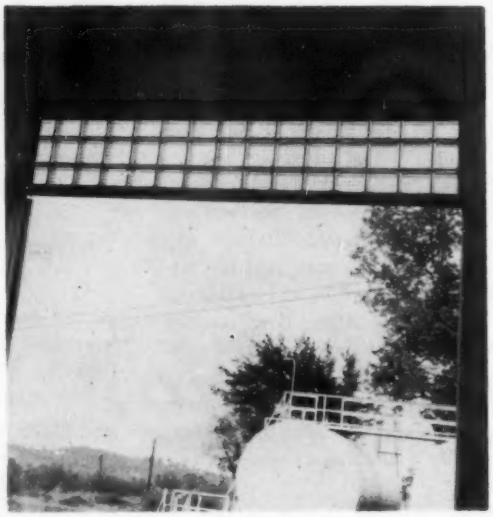
Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Stretching Doors

L. W. Fitzpatrick, Jefferson City, Missouri—Here is something to consider next time you enlarge your plant or build a new one. In planning our plant, we anticipated future load growth and allowed for the installation of additional engines. To facilitate the entry of large components into the plant, we arranged the rear doorway so that clearance could be increased easily when plant expansion became necessary.

Three courses of structural glass blocks were installed over the rear doorway. Extra clearance can easily be gained by removing the blocks. Since the blocks are replaceable and will match the opening perfectly, the costly and tedious operation or rebricking is eliminated. Then too, rebricking would always show the cutout and replacement. This way, it always looks like part of the plant architecture since we have other sections of glass block for light.



A sound idea. Items and ideas like this go a long way toward saving on costs when a plant's equipment is to be modified or augmented. The only time they count, however, is when they are incorporated in the planning stages—Editor.

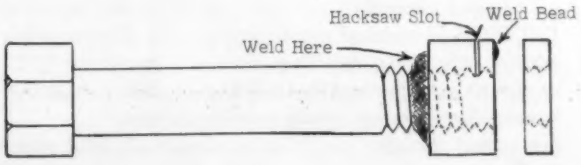
Stud Puller

J. H. Graham, Seattle, Washington—This suggestion is an adaptation to the old double-nut stud puller. We used this to pull some heavy studs on reduction gear case bearing cap studs. The design was such that the bearing caps would not come off without removing the entire top of the gear case. The lack of room made it impossible to use a pipe wrench even if you wanted to and were planning to scrap the studs later.

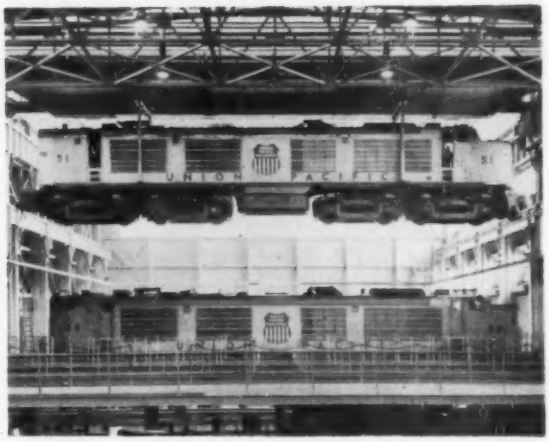
With a full nut welded about 1/3 on to the end of a long bolt of the same size as the studs, and other half-nut screwed onto the stud first and backed up as a lock nut, we pulled studs that were so tight it took two men on a 4-ft pipe on the wrench handle to break them loose. A spring lock washer, small enough to go inside the nut on the puller before it is tightened, seems to give less slippage.

For smaller sizes, a hacksaw slot about 1/3 through the nut and about 1/3 the distance from the end of the nut will help. A weld bead in the center of the arc of the slot will cause a binding action on the stud when the lock nut is tightened. The long bolt has the advantage of getting you out of tight spots to a place where you can reef on it.

With small standard size studs there are plenty of good pullers available, but on large and odd sizes this can be a real help.



news of our industry



High and Heavy

Hanging high above its tracks at Union Pacific Railroad's Salt Lake City diesel shop is a 551,000-lb gas turbine electric locomotive. Purpose of the lift was to test the 270-ton Whiting crane installed in the shop, and believed to be the largest railroad traveling crane west of the Mississippi. It was the first time that one of the huge 4500-hp locomotives, fully loaded and with trucks, has ever been lifted. Another of the road's 25 gas turbine electric units rests below.

Mobile Training Unit

Four motorized field training units have been placed in service by the Tractor Div., Allis-Chalmers Mfg. Co., to bring "at the door" service training on the new Allis-Chalmers diesel engines to the company's industrial dealer service organizations.

A unit with 2-man crew is assigned to each of the company's industrial sales and service territories. Assistance is given in the territories by company branch service personnel. The training is supplementary to the all-inclusive service instruction Allis-Chalmers provides at its Industrial Training Center in Springfield, Ill.

Each unit carries a tear-down engine which permits dealer service people to rebuild Allis-Chalmer diesel engines as part of their instruction. Also included with each truck are an operating diesel engine, cutaway assemblies, sub-assemblies, and visual aid facilities for a comprehensive training program.

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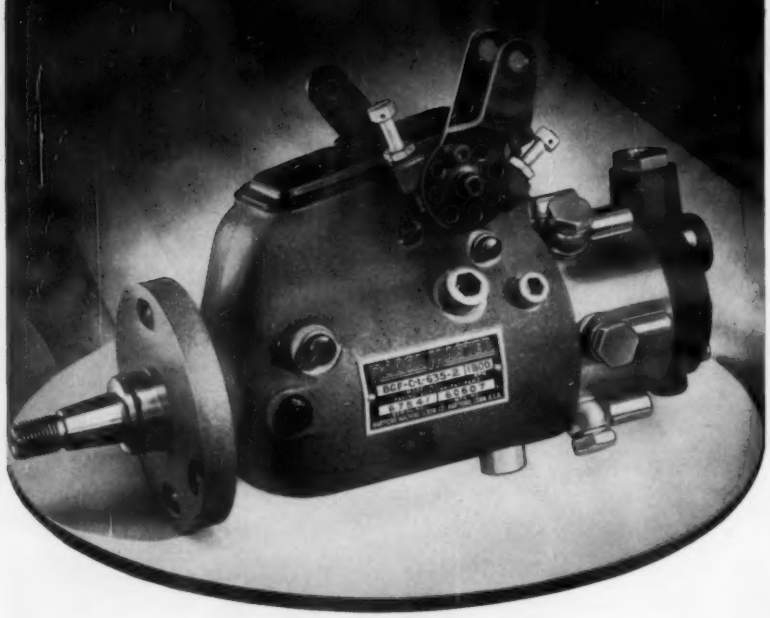
THE HARTFORD MACHINE SCREW COMPANY

Proudly Presents



THE NEW

ROOSA MASTER MODEL "B" PUMP

Another Great Advance

IN SIMPLIFIED DIESEL FUEL INJECTION

Another "first" for Roosa Master, the new Model B Diesel Fuel Injection Pump is . . . lighter . . . smaller . . . and more compact . . . yet retains the pace-setting simplified method of fuel injection pioneered by Roosa Master Model A. The new Roosa Master Model B offers both the diesel engine manufacturer and user outstanding performance, exceptional dependability and lower maintenance costs through easier servicing. Write today for complete information.

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DIESEL FUEL INJECTION AT ITS VERY BEST

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news of our industry

Small German Turbochargers

The German firm of Geratebau Eberspacher is producing small turbochargers suitable for engines above 244-cu in capacity, 70 to 150 bhp normally aspirated. These are currently being tested by a number of European automotive engine manufacturers.

Both turbine rotor and compressor impeller are of radial design, both overhung between a bearing support. This allows the blower to be operated independently of the engine as far as lubrication and cooling. In one series of tests on an engine with a pre-combustion chamber, developing 90 to 140 bhp at 2000 to 2500 rpm, an increase of 20% output was obtained with engine speeds as low as 30% of the maximum. At half engine speed, increase was 30%. Both were without exhaust discoloration.

With the same test engine an approximate 56% increase of output was achieved at maximum speed. Average reduction in specific fuel consumption of 8.5% to 9% was attained. During the tests a maximum boost of 1.42 atmospheres was recorded at blower speed of 35,000 rpm.

Weight of the turbocharger is 37½ lb; length 9 1/16 in; diameter 11 in. Blower casing is of cast aluminum and turbine casing of cast steel. Maximum speed is 38,000 rpm; maximum admissible exhaust temperature is 1265°F.

AERA Convention Set for May

Hotel Cleveland in Cleveland, Ohio, will be the scene of the 33rd annual convention of the Automotive Engine Rebuilders Assn., May 8-11, with convention activities following a pattern set last year. Conference periods with jobber-rebuilders visiting manufacturer booths will occupy three half-days and other half-days will be devoted to the business program and speeches by industry personalities. Among subjects set for the program are "Valves, Valve Failures, and Correct Procedures" and "Additives in Lubricants".

news of our industry

Sealed Power to Up Ring Output

A $300,000 expansion program has been set by Sealed Power Corp. for its piston ring plant in St. Johns, Mich. Approximately 5200 sq ft of floor space will be added to give additional chrome-plating facilities. Present demand for chrome-plated rings is said to be exceeding the capacity of both the Muskegon and St. Johns plants. Construction is expected to be completed by July.

Roadway Orders More Macks

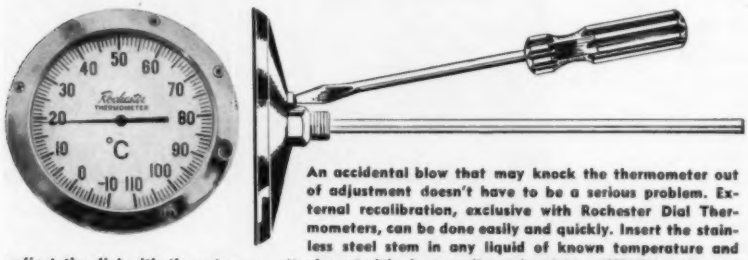
Roadway Express, Inc. has taken delivery of its second large order of Mack truck-tractors, consisting of 86 Model B65LT's powered by 170-hp Thermodyne diesel engines. These new models were developed after consultation between the two companies and feature contour cabs specifically designed for use with 35-ft square front trailers. They are said to permit maximum payload capacity within a 45-ft overall length limitation. As part of its expansion program last year, the motor carrier had ordered 85 Mack Model H61T cab-over-engine tractors.

British Piggyback Rail Riders

Soon to be introduced on British Railways is a type of piggyback operation servicing passenger traffic rather than freight. According to the announcement, motorists driving from London to Scotland become so fatigued by the required 2-day drive that the number of motor tourists in the Highlands has fallen off.

The plan for overcoming this problem is to run special combination trains this summer composed of flat cars for automobiles and sleeping cars for motorists. The 450-mi piggyback trip to Perth, Scotland will take 10 hr. By this new operation, the railway believes it will increase tourism to Scotland and earn revenue from those who might not otherwise travel by train.

EXCLUSIVE! YOU CAN RECALIBRATE THE ROCHESTER DIAL THERMOMETER EXTERNALLY . . . .



An accidental blow that may knock the thermometer out of adjustment doesn't have to be a serious problem. External recalibration, exclusive with Rochester Dial Thermometers, can be done easily and quickly. Insert the stainless steel stem in any liquid of known temperature and adjust the dial with the set screw attachment. It's done easily and quickly, EXTERNALLY, and is completely accurate.

Other plus features include:

All parts, except the crystal, are of corrosion-resistant stainless steel.

Hermetically sealed against moisture and grime.

All readings are completely legible and accurate.

Precision bi-metal helical element precalibrated to dial before assembly.

Stem position can be located anywhere around circumference of the dial in the STRAIGHT form thermometers.

Your Rochester representative will be glad to give you additional information, or address your inquiries directly to the Rochester Manufacturing Company, Rochester . . .

Rochester Manufacturing Company, Inc.
34 Rockwood St., Rochester 10, N. Y.
DIAL THERMOMETERS GAUGES AMMETERS

★ for DIESEL LUBE & FUEL OILS

NEW Honan-Crane **Full Flow Filters** give you **EXTRA HIGH flow rates—25 to 900 GPM!**

***plus** these time and money saving features*

Greater Filtering Efficiency
Designed for in-line installation. Every drop of oil in the system gets continuous filtration . . . solid particles down to micronic size (1 micron: 0.00004") are removed.

Large Dirt Holding Capacity
Uses remarkable new "Flo-Pac" Cartridge—a product of two years' research. Cartridge contains 44 square feet of filtering surface . . . has exceptionally long life.

Rugged Construction—Built of heavy gage, formed steel for heavy-duty service with a minimum of upkeep. No moving parts. Special cover and cartridge gasket seals eliminate leakage and bypassing of oil.

Sizes to Meet All Flow Requirements—The Honan-Crane Full Flow Filter is available in nine compact models using one to 36 "Flo-Pac" Cartridges. Flow rates range from 25 to 900 GPM to provide "custom" filtration in any application, large or small. Completely inert cartridge will not remove additives or inhibitors.

QUICK OPENING COVERS

Covers are fastened by swing bolts which can be loosened in seconds. Larger models have unique lifting device that raises and swings cover to one side for easy access to cartridges.

Write for 8-page Equipment Bulletin 101 giving full details.

305 WABASH AVE., Lebanon, Ind.

HH of Indiana

HOUDAILLE-HERSHEY OF INDIANA, INC.
FILTRATION DIVISION
a subsidiary of HOUDAILLE-HERSHEY CORP.

new products

Small Torque Converter

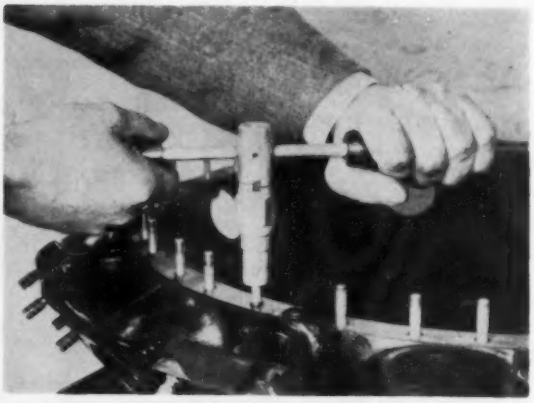
A multiple torque converter for small motors under 10 hp has been announced by Little Beaver Industries of Willoughby, Ohio. Called the "Fluomatic", it has been designed to boost power 2.8 times and at the same time provide "no-shock" starting and stopping.

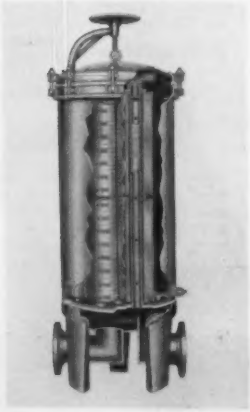
The Fluomatic unit is completely self-contained and consists of a turbine, reaction member, and pump, in an aluminum housing with a total weight of 27½ lb. The units are now available as a standard package unit or with custom modifications.

According to the development engineers, Lowe, White & Co., the units provide for easy power take-offs on intermittent or power loading. The manufacturer states that results have been excellent on screw conveyors, winches, hoisting devices, oilwell equipment, and numerous other machines.

Stud Driver and Extractor

E. V. Nielsen, Inc., 128 Broad St., Stamford, Conn., is producing a new stud driver and extractor designed to perform three stud operations. It extracts studs without the usual damage to threads, permitting maximum salvage in maintenance and repair work; for production and stud driving offers a quick, sure grip, instant shifting to pulling action where required, and adjustable control over driving depth. For removal of broken and stripped studs, a serrated collet is available. Five sizes are available which cover the entire range of stud sizes from 3/16-in to 3/4-in. Collets for both NC and NF threads are available as well as those for special threads and sizes. It is called the Service "Bi-Way" Studder.





New Honan-Crane Full-Flow Filters

A new line of Honan-Crane full flow filters offering flow rates up to 900 gpm has been introduced by the Filtration Div., Houdaille-Hershey of Indiana, Inc., Lebanon, Ind. New units can be used for filtering a wide variety of liquids including engine lube and fuel oils, metalworking oils and coolants, and parts washing solutions.

Designed for in-line installation, the new filters combine compactness with exceptionally high flow capacity to insure continuous filtration of entire oil or coolant supply. Nine different sizes are available using 1 to 36 cartridges. (Shown is cutaway view of 12-cartridge model.) Flow rates change from 25 to 900 gpm. Pressure drop across unit is 4 psi on oil of 170 SUS operating viscosity.

Extra-large dirt-holding capacity is obtained by new "Flo-Pac" cartridge designed especially for this filter. Resin-impregnated pleated paper cartridge has 44 sq ft of filtering surface. Filter element in cartridge is completely inert and will not remove additives found in many oils.

For POSITIVE LUBRICATION
It Pays to Specify
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PUMPS
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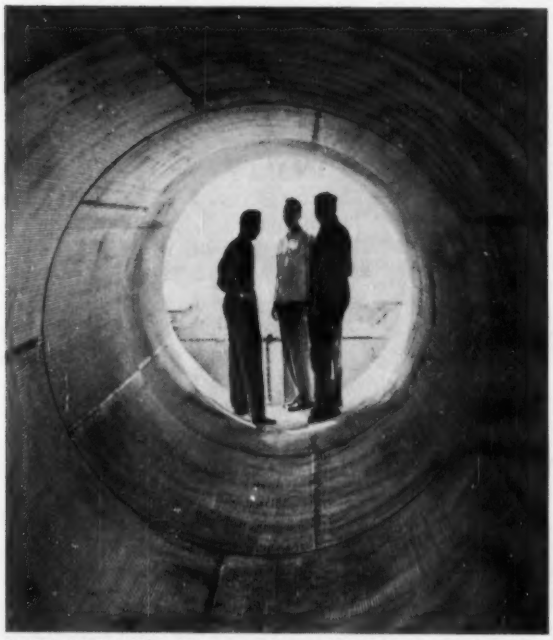

GIANT NOISE KILLER—This huge silencer is typical of many industrial and marine silencers designed and manufactured by Kittell Muffler & Engineering Company, Inc., 915 South Santa Fe Avenue, Los Angeles. Kittell silencers are available in a wide variety of standard sizes and types, including stainless steel and ceramic coated, in any quantities. Custom models engineered to meet your particular requirements. Excellent delivery. Write for catalog. *Experienced design and application engineers needed.*

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HORSEPOWER

. . . a size and type for every need

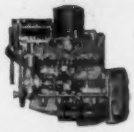
Whether it's repowering old equipment or buying new — too much or too little horsepower can prove costly. Equally as important as proper horsepower, is correct engineering of the application. Quite often, it is necessary that engine accessories be mounted in accordance with requirements of the equipment. It usually takes a right size and right design to supply the specific power needs for each type of machinery.

The engineering and sales policy of Hercules Motors Corporation is to design and sell internal combustion engines to fulfill the specific needs of each customer. For example, in equipment with limited engine installation area, "flat" or horizontal engines are often the answer. These engines can be placed under floors, or in any area which does not permit vertical installation. (Consult factory for models available.) Special Hercules vertical engines with accessories located on one side, permit installations near a firewall or bulkhead which is permanent and does not allow access to one side of the engine. These are but a few of the many problems which are often encountered in the proper application of an engine.

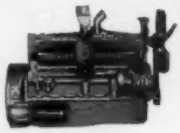
Our basic line of Hercules engines, 70 models from 3 to 500 H.P., is designed and engineered to meet the exact and varying demands of industry. We build engines for operation on gasoline, diesel fuel, natural gas, L. P. Gas, kerosene, or any other standard fuel that is readily available. That's why we have been known as "Engine Manufacturing Specialists Since 1915"

If you'd like to know more about our engines, write for the folder "Hercules Engines". It lists the sizes and power ratings of each model. If, however, you have a specific power problem give us the details. Our engineers will work with you to solve your problems and of course, there is no obligation.

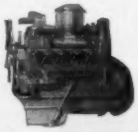
Hercules Model NXB
2 cylinder gasoline engine
15.6 H.P.



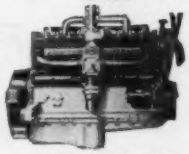
Hercules Model DOOD
4 cylinder diesel engine
79 H.P.



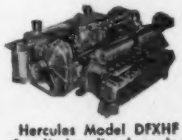
Hercules Model JXD
6 cylinder gasoline engine
112 H.P.



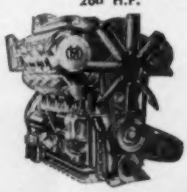
Hercules Model DIX6D
6 cylinder diesel engine
93 H.P.



Hercules Model HXE
6 cylinder gasoline engine
236 H.P.



Hercules Model DFXHF
6 cylinder diesel engine
260 H.P.



Hercules Model DNX-V8DTS
8 cylinder diesel engine
500 H.P.

Engine Specialists since 1915

HERCULES ENGINES

HERCULES MOTORS CORPORATION

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new products

Hole Cutting Saw

For anyone who has occasion to cut holes from 1⅛-in to 3½-in diam in metal, wood, or plastic, Robertson and Ruth, Box 534, Elmhurst, Ill., is producing the Model 400 dial saw. By rotating a graduated dial, three steel cutting blades adjust simultaneously to the desired pipe size.

The company indicates that in addition to its principal application it can be used as a rotary planer, inlaying tool, or grooving tool. It can be used with hand drills—electric and manual, drill press, lathe, and milling machine. The tool comes complete with three sets of cutter blades, one set for nonferrous metals and plastic, one for iron and steel, and the third for wood.

5000-Lb Fork Lift Truck

To handle loads up to 2½ tons, Towmotor Corp., 1226 E. 152 St., Cleveland 10, Ohio, has designed a Model 500-D lift truck, diesel powered. Claiming it as the most maneuverable and compact in its class, Towmotor states it has a turning radius of only 81 in, to operate smoothly in aisles 69-in wide. Detailed literature is available.

Protective Closures

Rubber and plastic protective closures for threaded parts, pipe, and tubing ends, called Shurclose, have been developed by Ray A. Scharer and Co., 3000 E. Grand Blvd., Detroit 2, Mich. Four types and 50 sizes are available as standard in rubber, accommodating up to 2½-in OD as caps and up to 3-in ID as plugs. In plastic 19 sizes are available, up to 1½-in OD as tubing caps and up to 1⅝-in ID as plugs.

new products

Metallic Putty

An aluminum putty claimed to shrink less than 0.2% while hardening, and not to crack in thick applications, is being made available for building up metal surfaces or for caulking seams and holes in metal and wood surfaces. Called Metalset A201, it is manufactured by Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

Though it hardens to a metallic density at room temperature, curing can be quickened with heat. It can be machined by conventional methods, tapped, or drilled. It is also said not to be affected by water and to resist acids and alkalies. It is recommended for marine repairs above or below the water line and for outdoor metal surfaces, including truck bodies.

Brake Drum Lathe

The biggest and heaviest drum and tire assemblies are given a fast and accurate job of reconditioning with its new No. 404 brake drum lathe, according to the Van Norman Co., Springfield 7, Mass. Turning and grinding are done at the same time.

Makeup of the machine includes a load compensator for ample support, a Vapo-Jet dustless grinder attachment which controls wheel loading and speeds up grinding, and a feed control for different feed ratings. Fingertip control is said to give instant tool bit location.

Control of Scale Formation

New Hydrotron equipment is being made available by Heller Laboratories, 124 Fort Lee Rd., Leonia, N. J., for control of mineral scale formation in heat exchange equipment. The new units have a 20% increase in capacity.

The tradenamed process changes the manner of mineral deposition from a hard cement-like coating to the form of a fine loose slurry that can be removed by blow-down. It is said to eliminate need for water softeners or chemical treaters, and to have unlimited life expectancy.

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in the right place
at the right time!

No. 5166-GS-B

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MECHANICS STANDARD SERVICE SET

● No time lost hunting *the right tool* when this carefully planned Snap-on set is at hand. No time-wasting "make-do" with sloppy misfit tools! Each of the 166 tools in the set is a basic in handling operations most frequently encountered in all types of maintenance work. In orderly arrangement in the big six-drawer chest, they are *safe,* and right at the finger tips when needed. Available through your nearby Snap-on factory branch. For free 104-page catalog of 4000 Snap-on hand and bench tools, write

SNAP-ON TOOLS CORPORATION
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*Snap-on is the trademark of Snap-on Tools Corporation.

new literature

Cooling Tower Pump Manual

A six-step manual for sizing cooling tower pumps and piping has been issued by Bell & Gosset Co., Morton Grove, Ill. The eight pages are patterned after the company's handbook to give a simple method which is accurate for general application. Also contained are selection charts and pipe sizing tables.

Power Transmitters

Its complete line of parallel shaft gear drives is described in a 32-page book published by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. Thirty-nine standard size drives together with baseplates and built-in backstops are listed. Standard ratio selections from 1.2:1 to 323:1, with hp capacities of over 2000, are said to be permitted with the drives. Complete engineering data is given.

Mechanical Failures of Metals

For many years the National Bureau of Standards has been examining metal parts that have failed in service for evidence bearing on the causes of these failures, undertaken at the request of other government agencies.

"Mechanical Failures of Metals in Service" has been issued by the bureau describing 35 such cases and representing the most frequently observed types of failures. Factors of design, fabrication, or use, contributing to the failures are presented. Characteristics by which the various types of fractures can be recognized are discussed and precautions recommended to reduce such failures are included.

The volume is illustrated with photographs of the failures discussed along with photomicrographs showing sources of failure. Designated Circular 550, it consists of 36 pages, 102 figures, one table, and sells for 30c. Orders may be placed at the Government Printing Office, Washington 25, D. C.

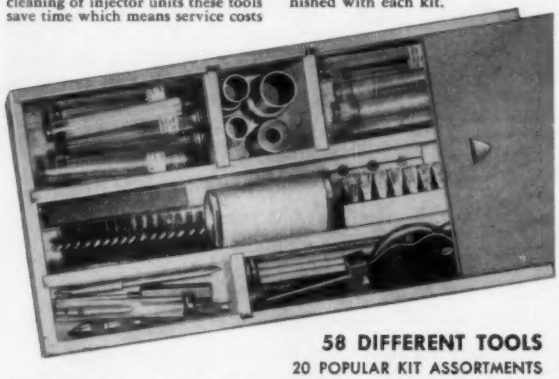
Pressure System Protection

Frangible Discs, Inc., Penns Grove, N. J., is issuing a series of catalog sheets covering the variety of uses of its product, frangible discs. The discs are pressure-relieving devices used to protect equipment or process systems wherever over-pressure is a problem.

The disc consists of a preformed metal rupture disc which is held between specially machined retainer rings and fits into the piping systems between standard pipe flanges. The rupture disc is a controlled point of weakness (like a fuse in an electrical system), which is designed to rupture at a predetermined pressure. The series of catalog sheets contains diagrams and tabular material covering design and dimensions.

Factory-Recommended Tools
Speed Diesel Nozzle Cleaning

Each tool has been specifically designed for a particular cleaning operation which cannot be done properly with ordinary tools. Besides insuring safe and efficient cleaning of injector units these tools save time which means service costs are lower, profits are up. Available individually or in kits containing the tools recommended for particular types or related lines of injection units. Complete instructions furnished with each kit.



58 DIFFERENT TOOLS
20 POPULAR KIT ASSORTMENTS

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All You Need to Know . . . About Cleaning Diesel Nozzles
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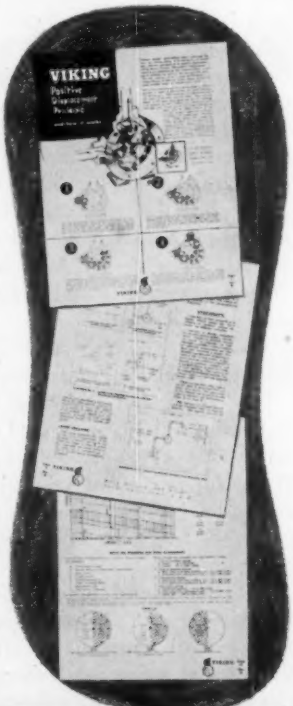
MORE HELP with your
PUMPING PROBLEMS
NEW 40 page VIKING Engineering Manual

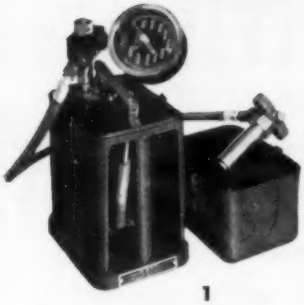
A new 3-part, 40-page engineering manual including Viking rotary pump fundamentals, the 10 steps in selecting a Viking pump, and a special engineering section will help you in choosing the right rotary pump for your job.



This manual is free upon request. Write today for Manual K d.

VIKING PUMP COMPANY
Cedar Falls, Iowa
See our catalog in SWEETS

KIENE® diesel engine test equipment



1

3

4

2

Kiene Adapters and Connectors available for all makes and models of diesel engines manufactured in U.S.A.

1. **Model KTP-50, Hydraulic Test Pump . . . designed for field service . . . portable . . . no bolts or clamps for leverage . . . many novel features.**
2. **Model K-120, Universal Indicator . . . for high-speed automotive type diesels . . . can be adapted to larger engines for firing pressure readings.**
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5. **Model UTS-10, Portable, Universal Unit Injector Test Stand . . . checks all sizes in one fixture.**

Kiene Diesel Engine Test Instruments are recognized throughout the industry for their accuracy and adaptability. They are designed for long service under most severe field conditions. Kiene equipment assures the proper maintenance of diesel engines . . . helps prevent costly down time. Get the facts on Kiene before you invest in diesel test equipment.

Send for Descriptive Literature

KIENE DIESEL ACCESSORIES, INC.
BOX 216, FRANKLIN PARK, ILLINOIS

new literature

White's New Diesel Tractors

Described in a sales folder issued by The White Motor Co., Cleveland 1, Ohio, are its new Model WC-24TD diesel tractors powered by Cummins Model NHB 4-cycle units of 180 and 200 hp. A feature of the models is their 96-in dimension from front of bumper to back of cab, permitting use of a 35-ft trailer within a 45-ft overall length. Reports from operators who have the models in regular service are also contained.

How to Run a Lathe

The 53rd edition of "How to Run a Lathe", a composite of 48 years of experience and research, and suggestions submitted by shop men, is being offered by South Bend Lathe Works, South Bend 22, Ind. It is available in paper binding for 50c or bound in imitation leather for $1.50 per copy. The new edition is 8 in by 5¼ in, has over 365 illustrations, and is 128-pages long.

Cook Packing and Piston Rings

Cookroc is the trademark of C. Lee Cook Co., 964 S. 8 St., Louisville 3, Ky., for three grades of laminated plastic used for compressor piston rings and rod sealing rings in metallic packing. A 4-page bulletin has been prepared listing the grades, their physical properties, and uses. Their application for different types of conditions are detailed, and ordering information is included.

Lube and Water Coolers

For service conditions encountered in diesel engine lube oil and jacket water cooling, Condenser Service and Engineering Co., Inc., Seaboard Trust Bldg., Hoboken, N. J., has released a 24-page catalog describing its AL coolers of the packed head removable bundle design.

Contained are description and illustration of the materials of construction, six pages of engineering data, tables of different types, maintenance factors, and application photos.

Roller Chains and Sprockets

A 64-page illustrated book has been published for distribution by Diamond Chain Co., Inc., Indianapolis 7, Ind. Entitled "Stock Roller Chains and Sprockets", it covers the company's complete line as stocked by distributors in every industrial area. The line includes minimum bore sprockets for reboring, as well as finished bore and Taper-lock bushed sprockets which are ready to use. Chain selection and application data are also contained.

Uses of Alloy Steels

Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y., is offering a 200-page handbook entitled "Alloy Steels Pay Off" to those interested in the utility of these metals in modern equipment. Economic advantages for improved weight-to-strength ratios, longer life and less maintenance, higher impact strength and shockload resistance, and corrosion and wear resistance, are discussed.

organizational news

Van der Horst Addition

Dr. Hyman Chessin has joined Van der Horst Corp. as assistant director of research and development. He will assist in product improvement and development as well as conduct research into broader applications for the organization's Porus-Krome and Vanderloy electroplating processes. Before this appointment Dr. Chessin did research at the University of Arkansas.

Dr. Hyman Chessin

J. A. Hardy

T. J. Weir

Schwitzer-Cummins Engineers

Two changes have occurred in the engineering section of Schwitzer-Cummins Co. James A. Hardy is now executive engineer and Thomas J. Weir is the new assistant chief engineer.

The appointments were made known by K. A. Beier, who was recently named vice president in charge of engineering and research.

New President of Centrico

O. Muller-Habig has been appointed president of Centrico, Inc., to succeed Heinz W. Habig who died last summer in a plane crash.

Mr. Muller-Habig is a director of Westfalia Separator A. G., Germany, of which Centrico is sole representative in the U. S. He has been business manager of the German firm for many years.

O. Muller-Habig

Since 1907

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The Symbol For

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DIE FORGINGS

DIESEL CRANKSHAFTS

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DROP FORGINGS

Weighing Up to 4,000 Lbs.

THE PARK DROP FORGE CO.

Gordon Park At E. 79th

Cleveland 3, Ohio

Full Automatic

ENGINE CONTROL

for Diesel, Gasoline or Gas

Dependable Synchro-Start controls provide full AUTOMATIC STARTING AND STOPPING according to the operation of any type of pilot switch. FULL PROTECTION is provided all the time the engine is starting or running. In case of an abnormal condition, such as low oil pressure, overheating, overspeeding, failure to start, etc., the engine will be shut down before any damage can occur and a VISUAL SIGNAL and an AUDIBLE ALARM will show the exact cause of failure.

Write today for the Synchro-Start catalog, or see your engine dealer.

SYNCHRO-START PRODUCTS, INC.

P. O. BOX 157-A, SKOKIE ILLINOIS

organizational news

Cooper-Bessemer Elevates Two

In recent elections at the board of directors of The Cooper-Bessemer Corp., Fletcher Devin was placed in the post of vice president, highlighting 35 years of his company service. Mr. Devin started as a sales trainee in 1919, working up through engineering and sales. For the past 20 years he has directed development of locomotive markets for C-B's diesel engines and is also currently a district sales manager for engine-driven compressors.

T. M. Lamberth, Jr., is now manager of the company's Shreveport, La. office to fill a position vacated by the death of A. K. De France. Mr. Lamberth's assignment follows extensive service with the corporation's engineering and manufacturing facilities in Mt. Vernon, Ohio.

Fletcher Devin

T. M. Lamberth, Jr.

Hydramotive Representatives

Two distributor appointments have been announced by Hydramotive, Inc., manufacturer of the Hydrotor hydraulic starting system. Mar-Oil Hydraulics, Inc., Hoboken, N. J., will cover the Mid-Atlantic area, and Miami Shipbuilding Co., will oversee the state of Florida.

Joy Vice President

Joy Mfg. Co. announces that it has appointed John D. Russell vice president of engineering. Mr. Russell has served the company in various engineering capacities since obtaining his degree in 1930. His last position was manager of engineering.

Cummins Sales Appointments

Paul J. Every is the new assistant general sales manager of Cummins Engine Co., Inc., a specially created position. He has been associated with the company since 1947 as manager of regions, and for the past two years has been responsible for world export activities. He was sales manager of the heavy equipment division at Baldwin before joining Cummins.

R. R. MacDonald has been placed in charge of the new Piedmont region of the organization. This latest sales territory consists of Virginia, West Virginia, and North and South Carolina. Mr. MacDonald was formerly manager of the Cummins Diesel Sales Corp. branch at Milwaukee. He also spent four years in various capacities with the Memphis branch of the corporation.

Paul J. Every

R. R. MacDonald

To speed the cleaning operation of DIESEL PARTS put F.O.-102 to work in your maintenance departments. This highly effective cleaner has been thoroughly tested to assure top performance. . . . When used in the prescribed manner it will save hours of hand labor and add to the life of pistons, piston rings, fuel pumps, carburetors and engine assemblies.

F.O.-102

INCORPORATES ALL THE ESSENTIALS SOUGHT IN A CARBON REMOVER

- *High Flash Point*
- *Low Toxicity*
- *Non-corrosive to metal surfaces*
- *May also be used as a cold dip*
- *Meets the requirements of AF-20043A*

For Cold Dip—Use fast acting

F.O.-185

(non-inflammable — low toxicity)

Also Available —
F.O.-128 and F.O.-101—Safe-tee Solvents
F.O.-106 and F.O.-116—Emulsion Cleaners

Our representative will be glad to call upon request. Write to Dept. 6

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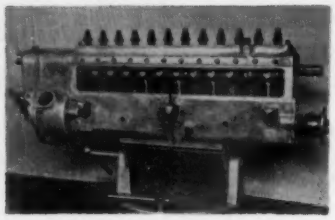
news of our industry



Soviet Fuel Injection Pump

Diesel-Taloudellista Kayttovoimaa, Finland's diesel magazine, has sent us the accompanying illustration of one of the fuel injector pumps contained in that country's diesel import from the U.S.S.R. They are installed in the T-34-85 tanks used by the Finnish army.

The injector is for a 12-cyl engine, with 10-mm elements which the army has been able to replace with Bosch, La Valetta and Fera elements. The elements were designed to be changed without opening the camshaft. For example, our correspondent states, when using the French elements it is not necessary to cut their guiding parts even if they are longer.

The outside of the injector, our correspondent further states, is very roughly built, but the important parts are well manufactured. The injector has been in use since 1943 and is still being used.

Finland, itself, produces two diesels for marine and stationary use—Tampella and Wickstrom. Diesel imports are mostly from England and Germany. Allis-Chalmers, International-Harvester, and Ford tractors represent principal U.S. exports.

Antifreeze Tester

Details of a new instrument to enable determination of the freezing point of antifreeze in radiators have been released by Armour Research Foundation of the Illinois Institute of Technology following their perfection of a new type of valve for Darbo Enterprise Co., developer of the basic mechanism.

The tester consists of a thermometer and a small cup enclosed in a plastic casing, and a tank of carbon dioxide. The liquid to be tested is frozen to slush in the cup by injecting liquid carbon dioxide. When the slush begins to melt, the thermometer temperature indicates the freezing point of the sample.

The new device offers a direct measurement of antifreeze. With the presently used hydrometer, specific gravity only is given. Then the information must be checked with specified tables for various commercial antifreezes to get the approximate freezing point, a method that is not accurate since many people mix different kinds of antifreeze in their radiators.

Research at the foundation was directed toward designing a valve that would accurately regulate the amount of carbon dioxide used to freeze the antifreeze. The valve developed prevents waste and reduces the cost of each test to less than half a cent. According to John C. Lee, supervisor, the tester may be used to determine freezing point of various solutions. It can test to a freezing temperature as low as -90°F.

Continuous Rails for Santa Fe

Santa Fe Railway has selected a stretch of mainline in its New Mexico Div. to be the site for "the first use by any American railroad of a new electric flash method of fabricating continuous welded rail." The new technique was developed in Switzerland and is known as the Matisa-Schlatter electric butt welding process. Elimination of the joint that is necessary every 39 ft with conventional-length rails is the advantage of the process.

Equipment for the project is housed in three 50-ft steel box cars to be spotted on a side track. New 39-ft rails will be fed through the cars to be subjected to the various welding, grinding, and testing procedures. Each rail will be fed directly onto a train of 31 flat cars having a capacity of 12 strings of continuous rail, which will measure about 1440 ft each. The new process will be used for about 27 mi of track in New Mexico and then will be moved to weld an additional 46 mi of continuous rail on other parts of the road's system this year.

Centrifuge Effect on Heavy Fuel

(*Continued from page 68*)

nozzles for discharge. It has been experienced on similar applications of this machine that inspection of the bowl is required only on a weekly or twice-weekly basis.

Strainers will require occasional cleaning. The function of the parallel units in the recycling line is to prevent any foreign particles or large sludge agglomerations from plugging the nozzles. The pressure gauge will tell when they need to be removed for washing and this can be done without interrupting the system. The strainer in the feed oil line is nothing new and its frequency of servicing will probably have been established earlier.

Summary

Test results show that this centrifugal machine will do as good a purification job as the more conventional type now in use. Further, the recycling feature demonstrates an ability to handle large quantities of dirty oil over long periods of time without the necessity of bowl cleaning.

Experience has not shown just how long the operation can be continued before the usual bowl-cleaning routine must take place. In any case, where the high capacity of this unit is required and extra dirty oils are to be used, the reduction in servicing operations will be welcomed with open arms.

They are individually designed, on thoroughly proved principles, to effectively correct any intake or exhaust noise caused by the flow of air, steam, or other gases. Stop that noise — profit through better neighbor and employee relations — eliminate costly oral errors — avoid compensation claims.

Tell us your noise problem and let us recommend—no obligation.

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BIG NEWS

FOR ALL DIESELS!

FRAM completely removes water from diesel fuel with NEW WATER SEPARATOR & FUEL FILTER

✓100% Water Removal! ✓Traps Dirt and Dust!
✓Cuts injector maintenance costs!
✓Reduces down-time!

The new FRAM Water Separator & Fuel Filter is a double-action filter for complete injection system protection—

1. Saves costly injectors from corrosion, rusting and pitting . . . removes all water!
2. Micronic filtration traps dangerous dirt before it reaches injectors . . . ends abrasive action!

Save the cost of replacing expensive injectors! Guard your diesels for longer life . . . less wear . . . fewer repairs—with the new FRAM Water Separator & Fuel Filter! For specific installation information write: FRAM CORPORATION, Providence 16, R. I. Fram Canada Ltd., Stratford, Ont.

IMPORTANT!

Diesels already equipped with FRAM Fuel Filter need only the Water Separator Filter and a new FRAM Coalescer Cartridge for 100% water removal!

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OIL • AIR • FUEL • WATER
FILTERS

NOW!

a *Faster* way to clean Heat Exchangers

No need for resorting to laborious disassembling and hand-cleaning when your heat-exchangers become clogged. Now, you can clean them *in place* the modern Oakite way by merely circulating a solution of specialized Oakite detergent through the tubes and shell! The soil is *chemically* removed—faster and more economically than any old-fashioned hand method. Check these other advantages:

- ★ Thorough soil removal
- ★ Cleaning action reaches all areas
- ★ Less wear and tear on units
- ★ Reduces unit down-time
- ★ Makes man-hours more productive
- ★ Reduces consumption of fuel and cooling water

Your local Oakite Technical Service Representative will be glad to give you more details. Call him today—or send for your FREE copy of illustrated pamphlet F9442. There's no obligation. Write Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

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Technical Service Representatives in Principal Cities of U. S. and Canada

news of our industry

Machinery Auction Sale

New York City was recently the scene of a huge auction sale of heavy roadbuilding and construction machinery. From its various branches, H. O. Penn Machinery, Inc. brought together more than 60 pieces of earthmoving and excavating equipment of different manufacture which were sold to the highest bidders. Expected demand for new equipment due to a projected roadbuilding upsurge caused the company to decide on a quick sale by auction to make room for new models.

Flood Control for Florida

Located mid-way between Lake Okeechobee and West Palm Beach, Florida is a new pumping station with a combined capacity of 2,160,000 gpm. It is the heart of a gigantic flood control system that may tame Florida's rampaging waters for all time. The station houses six 116-in Fairbanks-Morse horizontal axial-flow propeller pumps, each driven by a 1600-hp F-M opposed-piston diesel, which is claimed to make it the world's largest self-powered pumping station.

Diesels were chosen to drive the giant pumps primarily to insure continuity of operation during storm periods when the plant would be most needed and when electric transmission lines would be most vulnerable. They are also particularly suitable to operate axial-flow pumps at variable speeds to meet changing load conditions. Another factor is their economy in a plant where annual service equivalent to 52 days of full-capacity pumping is anticipated. Biggest factor, however, is their dependable weather-proof power supply.

The engines are 10-cyl units of 8⅛-in bore and 10-in stroke, turning at 720 rpm. Each engine drives its pump at a rated speed of 124 rpm through Morse double-reduction chain drives with a ratio of 5.80 to 1. Fuel oil flows by gravity from above-ground storage tanks to transfer pumps located in the basement beneath each engine. It is then pumped to separate day tanks mounted 36 ft above the operating floor.

Both jacket water makeup and raw water are taken from the West Palm Beach Canal. Electric power for lighting and for motor-driven auxiliaries is supplied by three 5-cyl, 720-rpm, Model 31A6¼S F-M diesels, freeing the station of dependence on outside power. A 28-hp, 1400-rpm, 3-cyl, Model 48AS4 F-M diesel drives a standby starting air compressor and a vacuum priming pump.

ASME Celebrates Diamond Year

On the campus of Stevens Institute of Technology, The American Soc. of Mechanical Engineers will commemorate its founding 75 years ago. On April 16, 500 persons are expected to attend ceremonies to recall a meeting which took place in 1880 on the same campus by 85 engineers as the start of a society which now numbers more than 40,000. Theme of the day's gathering will be "The Engineer and the World of Education".

New Piggybacks for New Haven

Two hundred new-type piggyback cars of French design will be acquired by lease from Piggy Back, Inc., the New Haven Railroad reports. Test models of the new cars have been constructed by the road on designs brought to this country by Piggy Back, Inc., which is now arranging for American manufacture.

The 75-ft long cars are capable of carrying two of the largest highway trailers now in use. New Haven's decision for the new equipment was based on its lower initial cost (each is about $8000), its lighter weight (50,000 lb), and its speedier loading and unloading time.

The cars are end-loaded from a ramp. Trailers move into position over two parallel beams which form the center sill of the car. An auxiliary set of flanged wheels attached to the trailer does the positioning and is part of the tie-down method. Trailer weight is on these extra wheels, none on the tires. Loading and securing time takes about a minute.

"AMOT" THERMOSTAT

"Performance without trouble" is the reason more engine manufacturers, pipe lines, power plants, oil companies and shipyards are using AMOT as standard for automatic engine water and oil temperature control. AMOT thermostats offer the following advantages:

1. Large capacity combined with light weight.
2. Excellent reliability even under extreme shocks and vibration.
3. No external bulbs or tubing to break and cause trouble.
4. Temperature is fixed and cannot be tampered with by operator.
5. Holds close regulation and is not sensitive to pressure.
6. Operating forces are very large and with no packing glands there is no chance of valve ever sticking or becoming inoperative.
7. Because of its simple and rugged construction, practically no maintenance is ever required.
8. Has positive 3-way valve action in which full pump capacity flows through the engine at all times.
9. Compact in size and will operate in any position, which facilitates piping.
10. Available in pipe sizes up to 6" for all types of gas and diesel engines.

Write for catalog and name of your nearest AMOT representative.

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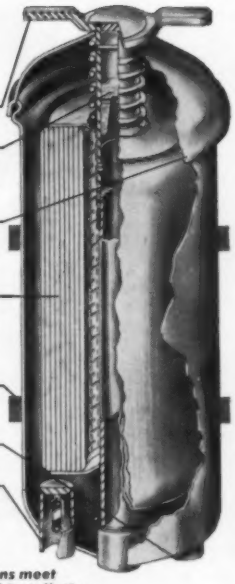

- *Hand control* for quick servicing. No wrenches required.
- *Exclusive dual purpose by-pass design* insures full oil pressure for maximum engine protection and longer element life.
- *Functional "O" ring seal*—The greater the pressure, the greater the seal. Eliminates constant gasket replacement.
- *Elements* are designed to give a maximum of filtration, accomplished by the use of perfected filtering media in relation to service requirements.
- *Sturdy clamp-type mounting* for safe installation under all conditions.
- *Drain* is located at the bottom of oil sump.
- *Inlet at bottom* for ease and safety of installation. Inlet check valve prevents drainback and undesirable turbulence.

Over-all dimensions meet truck or industrial installation requirements.

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Oil conditioning and full flow protection to all precision working parts of the engine are incorporated in the same unit. Cases are designed so that new elements may be replaced in a matter of moments.

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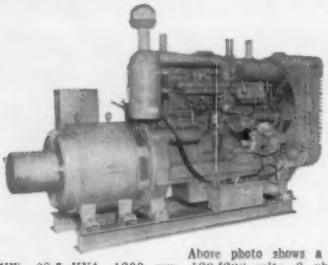
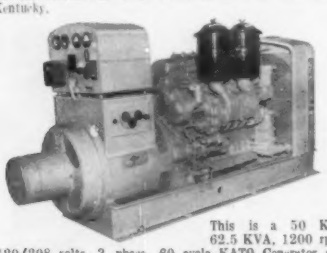
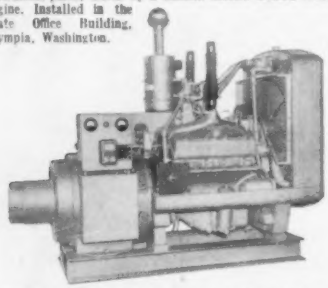


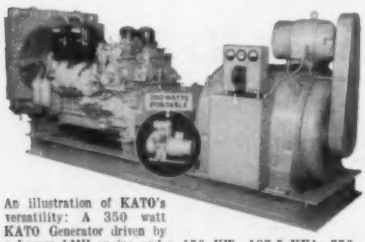
Above photo shows a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generators and instrument panel, driven by an International Model UD-18A diesel engine. Installed for the Mechanical Construction Division in Salt Lick, Kentucky.



This is a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by a General Motors 6030C diesel engine. Installed in the State Office Building, Olympia, Washington.



This pictures a 75 KW, 93.5 KVA, 1800 rpm, 240 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by an H-540 LeRoi engine utilizing natural gas for fuel. Installed for Republic Steel Corporation of Gary, Ind.



An illustration of KATO's versatility: A 350 watt KATO Generator driven by a Lauson LMH engine and a 150 KW, 187.5 KVA, 750 rpm, 120/208 volts, 3 phase, 25 cycle KATO Generator and instrument panel—driven by a General Motors twin 6-71 diesel engine. For Duluth, Mesabi & Iron Range Railway.

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news of our industry

NBS Demonstrates X-Ray TV

Using the X-rays produced by its 50 million-v betatron, the National Bureau of Standards has developed a system for the "X-ray televising" of internal parts of an operating engine. In a demonstration, the radiation from the betatron in combination with a recently developed technique for converting high-energy X-rays into visual images, showed the moving piston, piston rod and other parts in a small 1-cyl engine. This technique is expected to lead to the televising of the internal operation of a wide range of mechanisms.

Swiss Produce Articulated Bus

Zurich, Switzerland has commissioned production of a flexible bus designed to carry between 150 and 180 passengers in an overall length of 53 ft, 1 in. Consisting of two articulated units (two chassis mounted end to end), the bus has six wheels, four for the front chassis and two for the rear.

The wheels on the first and third axle are steerable, with the drive on the central axle. Power unit is at the rear end, a Sauer vee-form, 12-cyl engine, employing toroidal-type combustion chambers. Output is 240 bhp at 2000 rpm; maximum torque being 694 lb ft at 1400 rpm. Radius of the turning circle of the bus is given as 37¼ ft.

Articulation not only allows the vehicle to negotiate curves, but the front end can be inclined at angles up to 9 deg to the rear end to take on inclines, bridges, etc.

Northern Pacific Buys 2 RDCs

Two streamlined self-propelled rail diesel cars have been bought from The Budd Co. by Northern Pacific Railway. An RDC-2, 70-seater will be operated between Spokane, Wash. and Lewiston, Idaho. The other, an RDC-3, accommodating 48 passengers and a mail compartment, will be in service between Duluth and Staples, Minn.

Utility Buys Cat Mobile Set

Philadelphia Electric Co. has acquired a mobile 500-hp diesel-driven generator set to be used as temporary or emergency power during construction and maintenance periods. Built by Giles & Ransome, Inc., the set consists of a 1200-rpm, 12-cyl, Caterpillar D397 engine, a 375-kva General Electric generator, and control equipment, mounted in a Gramm single-axle van-type trailer.

To keep within weight limits when moving over highways, the trailer and much of the equipment were built of aluminum and all but bare essentials were eliminated. Speed and voltage regulator control has been provided so that the set may operate independently or in parallel with other generating equipment. A 300-gal fuel tank allows for 10-hr operation. A gasoline engine-driven air compressor is used for starting, with additional use of ether for cold weather.

Every effort was taken to reduce operating noise level in order to permit the set's use in different locations. The corrective measures include a specially designed radiator with a low-speed fan at the rear of the trailer, two mufflers under the trailer to silence exhaust noises, and fibreglass insulation on inside walls and roof to absorb engine noise.

Air Force Studies Power Sets

The Rome Air Development Center is sponsoring an investigation aimed at improving engine-generator reliability for ground electronic equipment. They are currently using a wide variety of these sets with 5-kw to 125-kw ratings, and difficulty is reported in getting proper performance, adequate supply of proper spare parts, and proper maintenance.

The investigation has been undertaken to establish practical limits on engine parameters, such as piston speed and mean effective pressure, and to set up criteria for selection of the right type of diesel engine for the particular application. Consideration is being given to engine auxiliaries such as cooling systems, fuel pumps, governors, etc., which will fit the intended service.

Mr. Ford's Idea

WILL WORK FOR YOU, TOO

Henry Ford believed in mass production—in producing so many MODEL T's that the cost per car was brought within everyone's reach.

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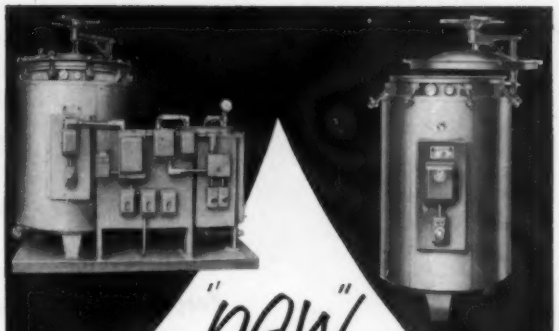

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again and again
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Getting ten times the normal service from lube oil—or more—is the customary result of putting Hoffman filtration and oil conditioning to work.

Hoffman Cartridge Filters, available in a wide range of capacities, use the filter media that's most effective for the needs of each application . . . whether the contaminating material is solid, gummy, or colloidal in nature.

Users of heavy Diesel equipment in utilities, transportation, and pipeline fields find that Hoffman filters and oil conditioning equipment ordinarily pay for themselves in short order through lube oil savings alone—to say nothing of the economy in time, labor, and space.

Hoffman Oil Conditioners, combining filtration and vaporizing actions both, have proved to be the answer to troubles of dilution as well as contamination. Automatic in operation, the Oil Conditioner removes solid contaminants by filtration, then bakes out all diluting materials of lower boiling point and viscosity.

Your copy of our Bulletin A974 contains full information of Hoffman Filtration and Oil Conditioning Equipment; we'll be delighted to forward it. Please write—

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SAVES YOU MONEY!

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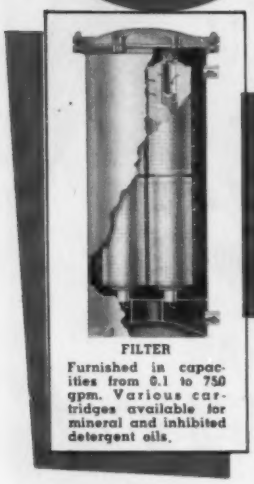


FILTER

Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.

HILCO FILTER CARTRIDGES

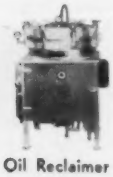
The result of much research in the field of lubricating, fuel and industrial oil filtration, the new patented HILCO Filter Cartridges meet the need for tremendous filtering area, low pressure drop and high dirt storage capacity. Above: Fig. 1 is a new cartridge; Fig. 2 is a used cartridge (note that pockets are completely filled and the outer surface covered with solids); Fig. 3 shows the flow of oil, the dark area represents dirty oil passing into the pockets while filtered oil (white area) passes into "S" shaped section.

HILCO Purification Means *Complete* Oil Purification . . .

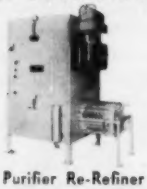
You get absolute removal of sludge, acids, carbon, water and fuel dilution with a properly selected HILCO. Clean oil saves you money. Expensive maintenance is reduced, equipment shut-downs practically eliminated, lost man hours and cuts in production become a thing of the past. HILCO continuous, all electric, automatic purification keeps your oil clean and in top condition at all times. You receive the full capacity and economy of your equipment.

HILCO offers a wide range of oil purification units to meet every oil conditioning problem. HILCO units are manufactured in both stationary and portable models. Write us about your purification needs . . . recommendations are given with no obligation. Let HILCO put its 25 years of experience in oil purification to work for you.

THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM



Oil Reclaimer



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news of our industry

Alco Seeks Name Change

Alco Products, Inc. will be the new name of the American Locomotive Co. if shareholders of the corporation agree at their annual meeting scheduled for April 19. The new name has been suggested to reflect the expansion of the firm's non-locomotive production and at the same time to keep the familiar Alco tradename for company identity.

In a letter to shareholders contained in Alco's 1954 earnings report, president P. T. Egbert pointed to the fact that more than 41% of sales were in growth lines, excluding output of locomotives and tanks. He forecast increase in sales of these growth products for 1955. Twenty-five years ago the company specialized in producing one product for one market. Today it is producing about 35 products for 11 markets.

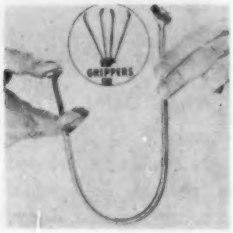
However, in forecasting 1955 business, Mr. Egbert indicated that the number of locomotive orders has increased, as well as diesel orders for export. "We want to make it clear," he stated, "that sales of new products cannot be expected to replace in the near future the large volume production of tanks and locomotives in the past."

UP Orders 50 Diesel Units

Union Pacific Railroad discloses it has contracted for 50 diesel-electric locomotives to be delivered this spring and summer. Thirty 2400-hp passenger diesel units have been ordered from the Electro-Motive Div. of General Motors. The American Locomotive Co. will build 20, 1000-hp switchers. Total cost of the units was estimated at $9,915,000.

On April 25, construction of 1000 freight cars will begin at the railroad's Omaha shops. First on the schedule are 100, 50-ton insulated box cars to be followed by 100 cabooses; 200, 50-ton box cars with 15-ft doorways; 300 stock cars with steel slats; and 300, 50-ton flat cars. All the cars are set for completion by the end of this year and will cost about $9,038,000.

new products



Gripper Tool

Addition of a retrieving and holding tool has been made known by Plomb Tool Co., Los Angeles 54, Cal. Called the Proto Grab-All, it is made in four lengths—12, 15, 18, and 24 in.

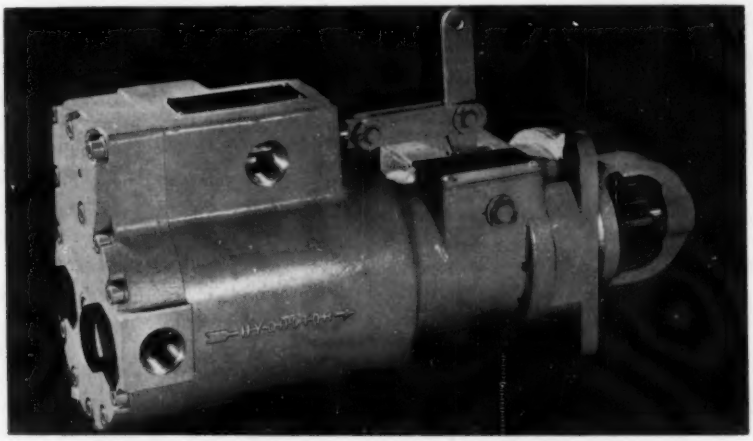
When the cap of the tool is pressed, a cable passing through the outer casing pushes four gripper out of the casing bottom. These expand outward for grabbing, a spring between the cap and finger bars pulling the cable back in the casing until a firm hold is obtained. The casing is flexible to reach around obstructions.

See-Through Cabinets

According to General Industrial Co., 5738 N. Elston Ave., Chicago 30, Ill., their steel cabinet with eight transparent drawers will answer many small-parts storage needs. Adjustable cross wise and lengthwise dividers also make it possible to set up various sized compartments in the drawers which are 5⅞-in long, 2¾-in wide, and 1 7/16-in deep. Each drawer has a safety catch so it cannot be withdrawn accidentally.

Pipe Vise

Jaws that grip with rocking wedge action provide exclusive advantages for its No. 1 pipe vise, according to Toledo Pipe Threading Machine Co., 1431 Summit St., Toledo 4, Ohio. These claimed benefits are firm grip non-crush action, and greater versatility to grip very small or large pipe (⅛ to 2½ in) as well as irregular shapes. Jaw action is also said to be such as to eliminate pipe marking.



HYDROTOR®

A new, revolutionary cranking motor for diesel and gasoline engines, the Hydrotor provides efficient starting at all temperatures in all climates. Three sizes fit all needs for farm, industrial, marine and military applications. The Hydrotor operates in a closed hydraulic system, independent of batteries. Cranking energy is easily restored to the accumulator by the hand pump.

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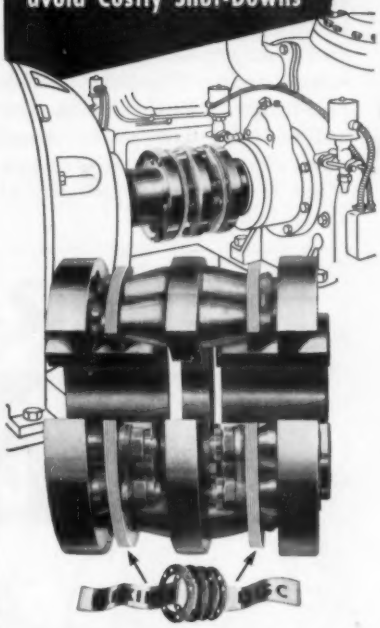
HYDRAMOTIVE, INC. 6723 Denison Ave. Cleveland 2, Ohio

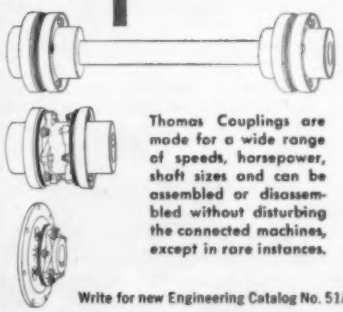
Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

new products

3-Way Illumination Kit

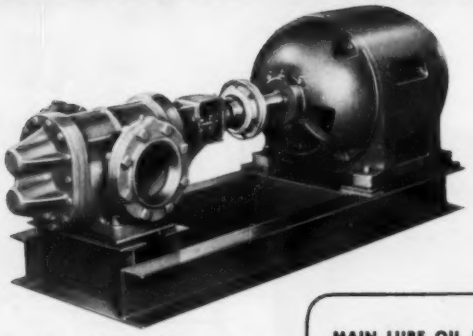
For critical seeing tasks, General Scientific Equipment Co., 2700 W. Huntington St., Philadelphia 32, Pa., is marketing a flashlight-battery-powered multi-purpose light kit. Attachments of the "Syte-Ayde" include four light-transmitting rods, straight and bent, and three power mirrors which clip to the rod ends, all contained in separate compartments of a plastic kit.

Friction Testing Under Load

What is claimed to be a new method of applying load and transmitting friction force to a measuring device has been embodied in a machine developed by Link Engineering Co., Detroit 27, Mich. Design of the machine is such that a test sample, such as brake lining, is held and made to ride on the rim of a revolving drum. At a point on the vertical center line, a horizontal friction force tangent to the drum surface will result. Samples under test can be loaded in 25-lb increments up to 200 lb.

ROPER PUMPS

Complete Pumping Service for the Diesel Field

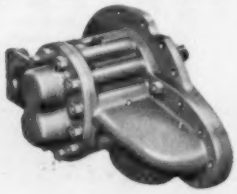


Series 3600—40 to 600 G.P.M. up to 60 P.S.I. Packed Box construction, hardened steel shafts, hardened alloy iron pumping gears. Heavy duty bronze bearings.

Series F—1 to 300 G.P.M. up to 300 P.S.I. Packed Box or Mechanical Seal construction, hardened steel shafts, steel pumping gears, heavy duty flange type bronze bearings.

Series K—1 to 50 G.P.M. up to 150 P.S.I. Packed Box or Mechanical Seal construction, hardened steel shafts, hardened steel pumping gears, heavy duty bronze bearings.

Custom—Adapting the Roper pumping principle to customer's requirements.



MAIN LUBE OIL PUMPS
Motor Driven
Engine Driven

STANDBY LUBE OIL
Before and After Pumps

FUEL SUPPLY PUMPS
Motor Driven
Engine Driven

AUXILIARY SERVICE PUMP
Fuel Transfer
Lube Oil Transfer
Hydraulic Power Control Pump

Write for catalog

ROPER Rotary Pumps

GEO. D. ROPER CORPORATION
164 Blackhawk Park Ave., Rockford, Ill.

Dual-Wheel Dolly

Alexander-Tagg Industries, Inc., Hatboro, Pa., has developed a lightweight, portable dolly which can be used on any surface, including the roadside, to handle the heaviest highway tire and wheel combinations. A 7-in overhang leaves room for the mechanic to work while the wheels rest on the back of the dolly. Ball bearing tracks allow the wheels to be easily pushed back into place on completion of work. Rated capacity is 2000 lb.

Solvents and Cleaners

A new line of degreasing solvents and cleaners has been announced by The Dacar Chemical Products Co., Pittsburgh 20, Pa., and designated Darsol. Solvents 650, 600, and 350, are designed as replacements for carbon-tetrachloride and other toxics, adaptable for metal cleaning where rapid drying and absence of film is necessary. Solvents 74-C, 45-A, and 62-B are emulsifying-type general cleaners which can be diluted with kerosene or water for removing dirt and grease on metal parts and equipment.

Aluminum Welding Electrode

To provide maximum weld quality in the inert-gas, shielded arc welding of aluminum, Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., has developed a new consumable electrode designed to be used with existing welding guns employed in the various processes. These include processes of Linde Air Products Co., Air Reduction Sales Co., and General Electric Co.

The electrode can also be used for tungsten-arc welding where the filler wire is fed mechanically to the work. It is currently being produced in three alloys—2S, 43S, and A54S—packaged and stocked on non-returnable fiber spools in various wire sizes.

new products

Universal Safety Skid

For moving, shipping, and storing of machine tools and equipment, Tumpane Co. of Georgia, Inc., Macon, Ga., is marketing the Tumco safety skid, made of heavy aluminum. It is based on the assembly principle of an erector set, and is available in 25 standard lengths to be used as either headers or runners to assemble about 325 different skid sizes.

Use of a wrench only is said to be necessary to assemble and load the skid. A completed 5 ft by 10 ft can be lifted by two men and yet have a load bearing capacity of up to 30,000 lb. Bottom faces of skid members are thicker than sides for longer wear periods, and have sufficient area to support heavy equipment on soft surfaces. Disassembly into different sizes is said to be easy. It also can be nested for storage in a small space.

Sideway-Moving Hand Truck

Manufactured by Directo-Truck Co., Inc., Canfield, Ohio, is a 2-wheeled hand truck that travels sideways as readily as forward and can be kept going in a straight line either way. Narrow aisles and doorways are thus no problem for wide loads. Tripping a wheel-shift lever causes wheels to turn and lock. Two accessory wheels convert it into a 4-wheeled truck if desired. Load capacity is 750 lb.

Hose Clamp Pliers

K-D Mfg. Co., Lancaster, Pa., has a new swivel jaw hose tool designed to overcome difficulties of servicing self-tightening wire hose clamps. Jaws swivel through 180 deg, to permit removal or installation of clamps in any position. Jaws are about 8-in long closing fully to completely expand small sizes. Handles are slim for deep reach.

Tapping Attachment

Latest of its tapping attachments with a capacity up to ¼ in, is designated Tapmatic 500 by Tapmatic Corp., 845 W. 16 St., Costa Mesa, Cal. It operates on a weightless tapping principle, no lead pressure required during operation. To reduce spoilage, a component torque adjustment clutch stops the tap instantly when it becomes dull, loaded, hits a hard spot, or bottoms in blind hole tapping.

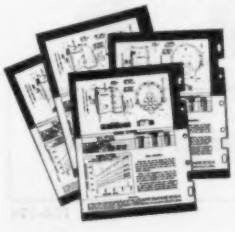
A reversing mechanism permits reversal at any time, and is so designed that reversing torque is automatically adjusted with driving torque through adjustment of the mechanical clutch. Also incorporated is a Jacobs rubber-flex tap chuck to accommodate its rated capacity taps, and which does not require individual tap holders. It is manufactured with a No. 30 Jacobs taper and can be furnished with all Morse taper arbors.

when the new power is a Diesel with

S-N REDUCTION GEARS

Operating cranes, pumps, shovels, draglines and similar heavy duty equipment can be mighty expensive when they're powered with ailing, old, slow speed gasoline engines with hard-to-get parts. Just switch to a modern high speed Diesel—plus a famous S-N Reduction Gear Unit—and keep your repairs and rebuilds to a minimum. That means less down time during the working season when it really hurts! And you save as much as fifty percent in fuel costs compared to a gasoline engine. Remember, S-N Reduction Gear Units insure smooth, full power from engine to load with maximum economy. Ideal for original equipment and all types of engines from 40 H. P. units to 755 H. P. giants. Range of reduction ratios—1.5:1 to 4:1.

Write industrial division for new catalog sheets.



SNOW-NABSTEDT

Transmission Engineers

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new products

Hydrostatic Dial Gauge

To be used on pressurized tanks, or tanks that operate under vacuum, an improved dial-type hydrostatic remote-reading tank gauge called Levelux Fuelmaster, is now in production by Liquidvision Gauge & Control Corp., P. O. Box 51, Oceanside, N. Y. It is equipped with a 12-in dial with easy-to-read graduations and a pointer travel of about 30-in.

Of the bellows-actuated type, it uses two lines to the tank. One is connected with an airbell and the other is an equalizing line connected to the vapor space. The pressure responsive element is a bellows, motion of which varies with head of liquid in the tank. Motion is conveyed out of the indicator housing by use of a magnetic coupling that actuates the pointer by a sector and gear, said to make it possible to use this gauge on any tank regardless of pressure. Nothing is required within the tank except a length of tubing or pipe for an air chamber. It can be furnished with switches to control valves, pumps, or alarm systems.

Xerograph Copying Equipment

Haloid Co., Rochester 3, N. Y., has a new Model 1218 xerograph copier which will reduce engineering drawings of up to 24 in by 36 in, onto a 12-in by 18-in paper master and make possible 100 copies in about 5 min. The originals are copied by reduction on a camera plate, transferred by the xerography process, and run off on an offset duplicator. Smaller sized drawings can be copied size for size or enlarged.

Thread Repair Kits

Those responsible for equipment repair may be interested in stainless steel wire thread inserts in the larger sizes which are now available in shop packs from Heli-Coil Corp., Shelter Rock Lane, Danbury, Conn. Twenty-six of these kits are being produced, each containing inserts, tap, and inserting tool in a metal-edged box. Box and tools are designed for long service by simply replacing inserts as they are used up.

Only three steps are required in repairing a thread with the inserts: drill out the damaged threads, tap new threads to accommodate the insert, and screw in insert.

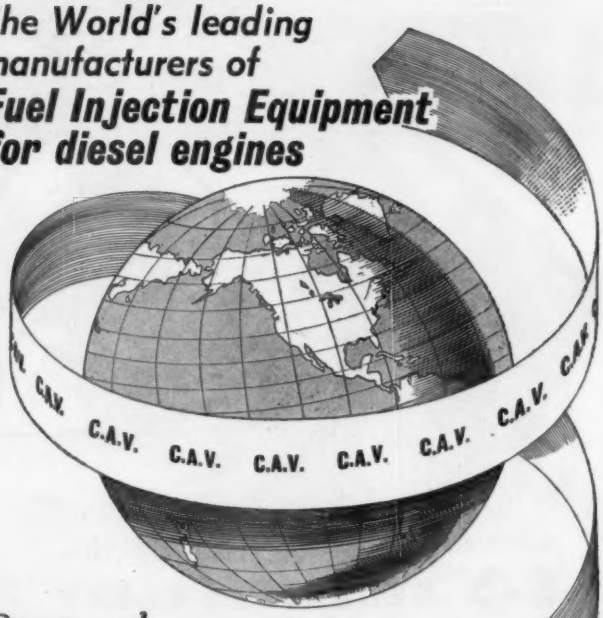
Cleaner-Conditioner Combo

A one-stop service product for automotive radiators and cooling systems, contained in a single package, has been produced by Permatex Co., Inc., 1702 Ave. Y, Brooklyn 35, N. Y.

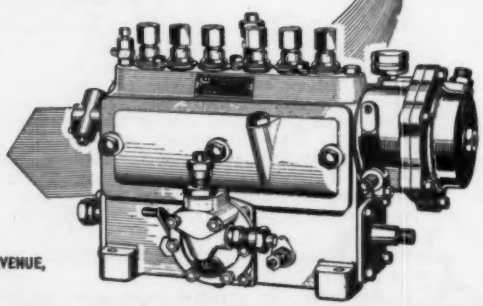
All the formulas needed to do four necessary maintenance jobs are contained, the company states. These include acids for dissolving accumulated rust, scale, and lime; a detergent for dissolving oils and greases and flushing them out; an anti-rust ingredient to inhibit reformation of corrosion, and a chemical sealer to halt leaks and seepage in the systems. In addition, there is a chemical to neutralize the acid cleaner.

C.A.V.

The World's leading manufacturers of Fuel Injection Equipment for diesel engines



Depots and Service Agents in over 100 countries



C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC.,
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Sales Office: 14820 DETROIT AVENUE, CLEVELAND 7, OHIO.

C.A.V. Fuel Injection and Electrical Equipment

174-606

new literature

National Fire Codes

A 6-volume edition of the National Fire Codes, a compilation of 162 fire safety standards, has been published by the National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass. All standards in this latest edition have been completely revised as of July 30, 1954.

The codes have been enlarged to six volumes for the first time with the addition of the new transportation volume (No. 6), containing fire safety standards for air, marine, and highway transportation. The codes and standards are purely advisory but are widely used as a basis of good practice and for legal and insurance purposes. They sell for $6 per volume.

Alloy Temperature Properties

The third in a current series of reports on the effect of temperature on the properties of metals, has been announced by the American Soc. for Testing Materials, 1916 Race St., Philadelphia 3, Pa. This latest concerns elevated temperature properties of super-strength alloys.

Primarily this report is a graphic summary of data on 13 alloys, including 116 curves showing tensile strength, 0.2% offset yield strength, elongation and reduction of area percentage, stresses for rupture up to 100,000 hr, and stresses for creep rates of 1% up to 100,000 hr. A brief description of each alloy is given, along with an appendix on very-short-time rupture data and a compilation of chemical compositions. The 208-page, paper-covered report sells for $4.75.

Baldwin Torquemeters

A 12-page bulletin has been issued by Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa., to describe its SR-4 torquemeters and their applications. Each unit consists of a torque pickup and a torque translator instrument.

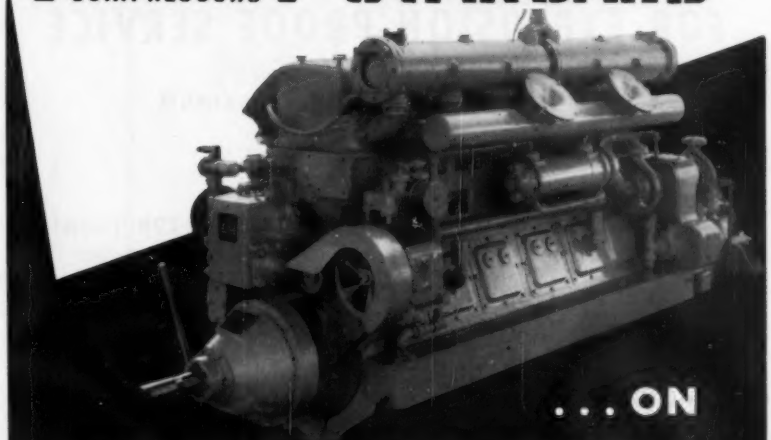
The pickups, further applications of bonded wire strain gauges, measure torque in terms of a few in-oz to thousands of ft-lb. Eight torque pickups, 0-100 to 0-300,000 in-lb, and five types of instruments, including manual null balancing and automatic indicators and recorders, are also described and illustrated.

Breather Filters

Its complete line of "oil-wetted" and "oil bath" breather filters is illustrated and described in a folder offered by Air-Maze Corp., 25000 Miles Rd., Cleveland 28, Ohio.

The filters are designed for installation on crankcases of engines and compressors, gear cases, hydraulic equipment, etc. Design features include large filter surface area, vibration-proof filter media, cleaning ease, and flame arrester. Engineering drawings and photographs accompany descriptions, along with detailed specifications and operating advantages.

Quincy COMPRESSORS STANDARD



. . . ON ATLAS IMPERIAL DIESELS

The National Supply Company has standardized on Quincy Compressors for starting their Model 45 Atlas Imperial Engines. Atlas Diesels are known for their dependability. And an engine is just as dependable as its accessories, so National engineers have selected Quincy — the finest in air compressors.

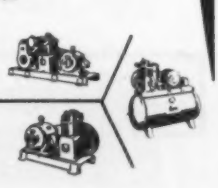
You want dependability too, so standardize on Quincy Compressors.

There's a model for every application. Sizes run from 1 to 90 c. f. m.

Write Dept. J-42, Quincy Compressor Co., Quincy, Illinois, for more information on Quincy units for diesel starting.

QUINCY COMPRESSOR CO.
QUINCY, ILLINOIS

MAKERS OF THE WORLD'S FINEST AIR COMPRESSORS



new literature

Worthington DH Engines

Construction details, applications, and latest design features are presented in the latest bulletin of Worthington Corp., Harrison, N. J., on its Type DH engine designed to operate three ways—as diesel, dual-fuel, or spark-ignition.

In addition to specifications, a 3-page schematic spread illustrates the various component parts. Separate charts show fuel costs per gallon for each fuel used and a ratings chart indicates bhp for the 5-, 6-, and 8-cyl engines at 600 rpm.

Symposium on Road Equipment

The American Road Builders' Assn., World Center Bldg., Washington 6, D. C., has issued Technical Bulletin No. 209, containing six papers on road machinery and equipment. Subjects range from mechanization of construction operations, through equipment development, to military road and airfield construction. Represented are the contractor, the manufacturer, engineer, public highway agency, and the military services.

The papers are illustrated with historical, operational, and maintenance photographs, and annotated with tabular matter on equipment types, service reports, and percentage tables of repair parts and equipment investments. The booklet sells for $1.50.

Daros Piston Rings

In a 24-page bulletin, Daros American Corp., 8128 N. Lawndale Ave., Skokie, Ill., gives a detailed picture of the manufacture of Davy Robertsons piston rings. The Illinois firm has recently moved to larger quarters in order to handle the volume of sales expected by its recent appointment as American distributor for the Swedish rings.

The 104-year Robertsons firm's engineering development—the booklet states it was "the world's first commercial manufacturer of piston rings"—is detailed in the first part of the publication along with its foundry operations. Other sections deal with various styles of rings, recommended ways of selecting ring combinations, and how to order the rings for best application.

Fageol-Leyland Diesels

Complete mechanical specifications, horsepower and torque curves, and dimensional drawings, are features of the latest bulletin on its Fageol-Leyland diesel engines issued by Twin Coach Co., Kent, Ohio. Horizontal and vertical models of both the 600- and 680-cu in units are described in detail.

According to the manufacturer, the engines are currently being used as replacements for worn gasoline engines in old large-capacity buses. Fuel and maintenance savings are said to be effected. Other uses include marine, truck, and industrial stationary.

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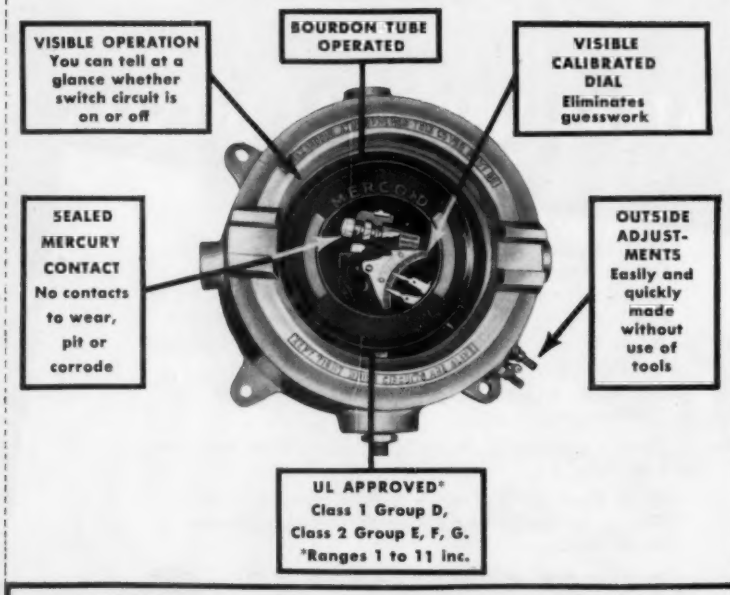
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new literature

Diesel Service Equipment

Bacharach Industrial Instrument Co., 7301 Penn Ave., Pittsburgh 8, Pa., has released a set of catalogs on the testing equipment it manufactures for servicing various diesel models. Currently available are six folders.

The first five are for diesel tractors of Cockshutt; Case Model 500; Massey-Harris Models 33, 44, and 55; John Deere Models R and 70D; and the Fordson Major. Each describes essential shop equipment for servicing the models: nozzle testers, nozzle connector testers, compression testers, nozzle cleaning kits, nozzle assembly tools, and nozzle valve lapping plates. The sixth catalog lists equipment for testing Waukesha diesels. All the catalogs give price and ordering information and illustrate typical nozzle cleaning operations.

Welding Information

Available from Metal & Thermit Corp., 100 E. 42 St., New York 17, N. Y., is a set of literature designed to be of help to welding engineers concerned with production and maintenance welding. The series of catalogs describes the entire line of the company's electrodes for arc welding as well as rods and wire for gas, submerged arc, and inert arc.

Different catalogs cover electrodes for mild steel and low alloy, coil wire for submerged arc welding, stainless steel electrodes and bare wire, aluminum and phophor bronze electrodes and bare wire, aluminum electrodes and bare wire, electrodes for cast iron, gas welding rods, and tungsten rods. Each catalog contains information on physical properties, chemical analyses, qualifications, procedures, sizes, and general engineering data.

Gas-Engine-Driven Compressors

All the features of its Type SVG, 4-cycle, gas-engine-driven compressors, ranging from 330 to 660 hp, are covered in a 44-page bulletin from Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

Details of construction are illustrated in cross-section drawings, with a special 5-color cross-section tracing the paths of fuel, exhaust gases, lubricating oil, cooling water, and the gas being compressed.

Special sections cover specifications and dimension data. There are 10 pages of photographs of the compressor at work in various applications. The companion gas-engine power unit, the PSVG, is also described.

Power Shovel-Crane Operation

For the operator of power cranes, shovels, and draglines, a 32-page manual has been published by the Power Crane and Shovel Assn., 74 Trinity Pl., New York 6, N. Y. Priced at 15c per copy, the booklet, entitled "125 Ways to Better Power Shovel-Crane Operation", is written in informal style and spotted with cartoons to drive each point across. Back of the book is an illustrated summary of hand signals.

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organizational news

Purolator Elections

James D. Abeles has been elected president and chief executive officer of Purolator Products, Inc., to succeed Ralph R. Layte who has become vice chairman of the board of directors. H. Joseph Market will proceed to Mr. Abeles' former post of executive vice president.

J. D. Abeles

H. J. Market

Mr. Abeles became associated with the company in 1940. Since then he has filled the various positions of assistant to the president, equipment sales manager, assistant works manager, assistant plant superintendent, quality manager, cost reduction engineer, and executive vice president and general manager. Mr. Market joined Purolator as general auditor in 1946. His most recent position was as comptroller of the company.

Executive Changes at Koppers

At a special meeting of the board of directors, W. F. Munnikhuysen was elected chairman of the board and Fred C. Foy was named president and chief executive officer of Koppers Co., Inc. These fill vacancies created by the death of General Brehon Somervell who had been both chairman and president.

In a later disclosure, it was revealed that a company-wide marketing department has been formed under direction of Ralph Winslow, vice president. It will cover primary functions now carried on by the central sales staff and public relations departments.

Trane Promotes Three

Three sales engineers have recently been given executive positions in The Trane Co. sales organization. Each will manage his separate organizational units, which have been set up to handle increased volume of business.

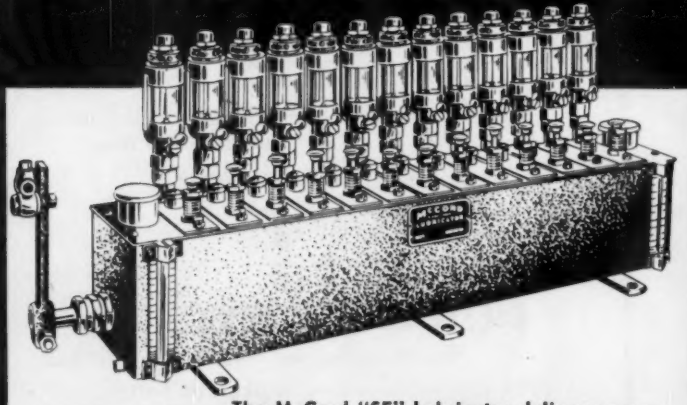
Werner G. Wassmandorf will manage the reciprocating compressor sales department, Lloyd E. Eater will head fluid cooler sales, and Wilfred R. Barnard will be manager of Uni-Trane sales. All three joined the company in 1952.

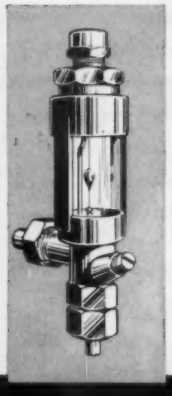
Exide Elevation

William C. Leingang, former assistant general manager of the Exide automotive products division of The Electric Storage Battery Co., has been named assistant to the president.

Mr. Leingang's service with the company dates from 1923 when he joined the Detroit sales office. He transferred to the main office in 1935 and became executive assistant to the executive vice president. Beginning in 1947 he spent six years as Chicago manager.

McCORD "Tubular Clearsite" Feed
SF LUBRICATOR





The McCord "SF" Lubricator delivers a predetermined quantity of oil under pressure at regular intervals to cylinders or bearings. A new improved tubular clearsight feed, a McCord development, shows delivery and quantity of oil. It may be cleaned without removing from pump. Other McCord advantages are easy removal of pump units, welded steel tanks, wide variety of drives, and a new graduated oil level gauge providing greater visibility. McCord offers you an outstanding lubricator, further improved to provide better service. Deliveries are prompt.

LUBRICATOR DIVISION
McCORD CORPORATION
Detroit 11, Michigan

organizational news

Burgess-Manning Buys Penn

Penn Industrial Instrument Corp. has become a division of Burgess-Manning Co. by corporate merger. It will continue to manufacture its line of instruments at its Philadelphia plant.

William C. Bennett, formerly president of Penn, has been elected vice president and a director of the parent company and will manage the new division. William Melas, formerly vice president of Penn, is now a director of Burgess-Manning and will continue in charge of engineering and development. George D. Keller continues in charge of sales, assisted by William Braun who recently joined the company.

Kent-Moore Vice President

At a meeting of the board of directors of Kent-Moore Organization, Inc., T. F. Walker was chosen executive vice president. His association with the company dates from 1940, since when he has variously served as experimental engineer, chief plant engineer, general factory manager, production vice president, and manufacturing vice president.

Westinghouse Air Brake Change

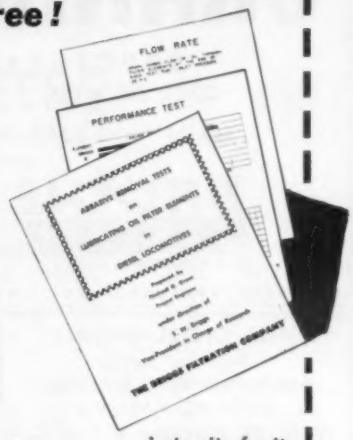
Moving up from the post of advertising and sales promotion manager of the Le Roi Div., Richard H. Koehler is now director of advertising and publicity for Westinghouse Air Brake Co. He will supervise and coordinate these activities with the company's divisions and subsidiaries.

Richard H. Koehler

Mr. Koehler succeeds Joe H. Serkowich, who recently resigned to go into advertising. Before joining Le Roi two years ago, Mr. Koehler was advertising manager of Stearns Magnetic, Inc.

A NEW BOOKLET PACKED FULL OF COMPARATIVE MEDIA PERFORMANCE FIGURES — A GUIDE IN MAKING FILTER SPECIFICATIONS — *yours free!*

Covers white cotton waste, cotton linter/wood fiber, mixed cotton waste and disc-pac media evaluated under carefully supervised testing conditions. Rate of engine wear from abrasive material, bearing failure due to abrasive dirt, unloading, performance, particle selectivity, flow rates are but a few of the many high points in this new report made for two major railroads. This report completely evaluates abrasive removel properties of various types of lubricating oil filter elements now in use on locomotive diesel engines.



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Briggs — PIONEERS IN MODERN OIL FILTRATION

YES! THE BRIGGS FILTRATION COMPANY, Dept. 60, WASHINGTON 16, D. C. Send me your new booklet "Abrasive Removal Tests on Lubricating Oil Filter Elements in Diesel Locomotives".

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- STRAIGHTENING
- THERMIT WELDING
- METALLIZING
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LARGEST CRANKSHAFT GRINDER IN A JOBBING SHOP

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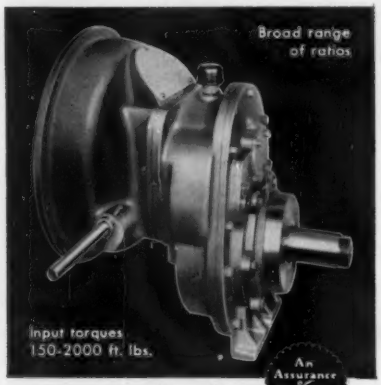
Parts and Service
Models—B-BP-PBM, A-PA-PAM,
C-PCM-PC, V-VM, V-8
W. H. W. Machine & Tool Co.
406 Olds Avenue Lansing, Michigan



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- Transmissions
- Reduction Units
- Mechanical Drives for Torque Converters

Cotta Transmission Co., Rockford, Illinois

COTTA
HEAVY-DUTY
TRANSMISSIONS

"Engineered-to-order"

organizational news

Admiral
W. D.
Leggett, Jr.

Admiral Joins Alco

Rear Admiral Wilson D. Leggett, Jr., retired chief of the Navy's Bureau of Ships, has become vice president of engineering of American Locomotive Co. He is expected to assist the company in its program of expansion into new industrial markets.

Admiral Leggett is said to have been instrumental in initiating and completing a program of diesel engine development which freed the Navy of dependence on German designs and made possible successful diesel-electric propulsion during World War II. He has a Master of Science degree in diesel engineering from Columbia University.

Enterprise Sales Posts

Four new appointments have been made in the sales organization of Enterprise Engine & Machinery Co., subsidiary of General Metals Corp. Dale W. Blanton is now manager of contract engineering, Robert A. Thompson has become senior contract engineer, George Heuer is named contract engineer, and Austin B. Crouchley has taken the post of sales engineer out of New York.

Mr. Blanton has been with Enterprise since 1950, prior to which he was sales engineer for Atlas Imperial Diesel Engine Co. Mr. Thompson joined the company in 1937 and was last project engineer. Mr. Heuer, previously a research and development engineer specializing in turbocharging, came to Enterprise three years ago. Mr. Crouchley has been with Chicago Pneumatic Tool Co. as Chicago sales engineer.

Wyman-Gordon Executive Shifts

In recent elections, Robert W. Stoddard was named the new president of Wyman-Gordon Co. He succeeds Harry G. Stoddard who has been president since 1931 and is now chairman of the board of directors. Honorary chairmanship of the board has been given to George F. Fuller who has been with the company for 67 years, starting as office boy. Sacket R. Duryee is now vice president as well as treasurer.

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organizational news

B. G. Van Zee

New ICEI President

B. G. Van Zee, chief engineer of the automotive engineering division of Minneapolis-Moline Co., is the newly elected president of the Internal Combustion Engine Institute. Former president, J. E. Heuser, general sales manager of the Le Roi Div., Westinghouse Air Brake Co., was elected to the board of directors. Other elected officials are: vice president—E. Don Tull, vice president and general manager, Cummins Engine Co., Inc.; secretary—H. W. Smith, consulting engineer, Engine Div., Caterpillar Tractor Co.; and treasurer—Phil Norton, vice president in charge of sales, Wisconsin Motor Corp.

Aeroquip Acquires Canada Firm

All of the assets of Prenco Progress & Engineering Corp. of Toronto, relating to its flexible hose and self-sealing couplings business, have been obtained by Aeroquip Corp. It will be operated as a subsidiary known as Prenco-Aeroquip, Ltd., utilizing the same quarters until larger facilities are obtained. The newly purchased firm had formerly been licensed to manufacture Aeroquip products in Canada.

Brown Boveri Buys Stockwell

Stockwell Transformer Corp., Akron, Ohio, has been merged into Brown Boveri Corp. According to a recent announcement, the name of Stockwell will be discontinued as well as its manufacture of transformers under 2500-kva. The parent company plans to build a combination service center and warehouse unit for the servicing of both Brown Boveri and Stockwell equipment.

Nordberg Sales Engineer

H. T. Anderson has been appointed Pacific Coast sales engineer, Heavy Machinery Div., by Nordberg Mfg. Co. He comes to the organization from Enterprise Engine & Machinery Co. with a background in the design, production, and sales of diesel engines. He was manager of the New York office for eight years and has been assistant general sales manager since 1953.

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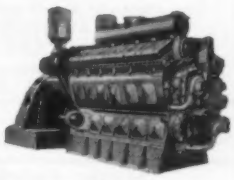

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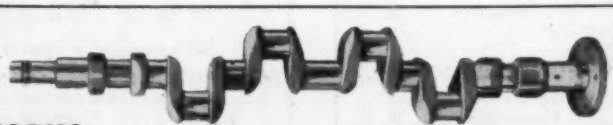

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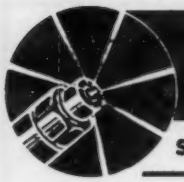

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What Do You Know!

(*Answers to Questions on Page* 64)

1. Correct answer is "b". The statement would be correct if "fine" were substituted for "coarse". For a discussion of injector repair, read the article on Page 69.

2. Correct answer is "c". Lacquer films may be invisible and the coating too thin to measure. Turning the needle in the paper towel produces a distinctive squeaking noise. Read article mentioned above.

3. Correct answer is "c". By maintaining constant pressure, a constant multiplier can be used to compute the amount of gas consumed. For details see article on Page 62.

4. "c" is correct answer. The otoscope is commonly used for looking into ears, nose, etc. It combines a source of light, magnification, and a direct line of sight into deep holes. Thus it is very useful for checking injector needle seats. See article on Page 69.

5. Correct answer is "b" Restricting the intake air in accordance with reductions in lead permits reduction in the specific fuel consumption without excessively lean mixtures. With a fairly constant air-fuel ratio, exhaust temperatures will be constant too. In fact, some engines use exhaust temperatures as a reference to control the intake air restriction. See the articles on Pages 50 and 62 for discussion of different phases of this.

6. Correct answer is "b". While the percentage of pilot oil is relatively small and possibility of reduction is limited, appreciable savings may be made. Where gas is cheap, even small savings in the cost of the more expensive oil can mount up. See the article on Page 62.

7. Correct answer is "a". This amount is considered to give adequate protection. For details, see the article on Page 72.

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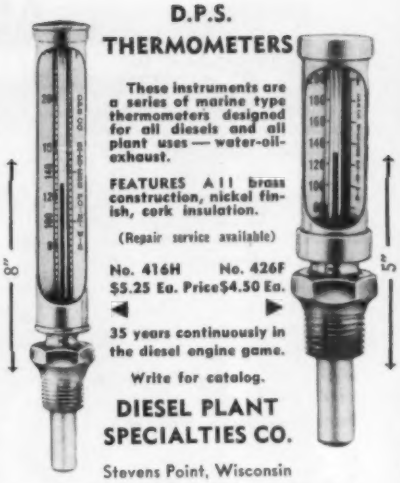

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